DOCUMENT RESUME

ED 406 419 TM 026 341

AUTHOR	Beaton, Albert E.; And Others
TITLE	Mathematics Achievement in the Middle School Years. IEA's Third International Mathematics and Science Study (TIMSS).
INSTITUTION	Boston Coll., Chestnut Hill, MA. Center for the Study of Testing, Evaluation, and Educational Policy.; International Association for the Evaluation of Educational Achievement.
REPORT NO	ISBN-1-889938-02-5
PUB DATE	96
NOTE	243p.; Funding for the international coordination of the Third International Mathematics Study is provided by the U.S. National Center for Education Statistics, the U.S. National Science Foundation, the International Association for the Evaluation of Educational Achievement, and the Canadian government.
AVAILABLE FROM	Boston College, Center for the Study of Testing, Evaluation, and Educational Policy, Campion Hall 323, Chestnut Hill, MA 02167; ($30--international customers add $7.50 for postage); http://wwwcsteep.bc.edu/timss
PUB TYPE	Reports - Evaluative/Feasibility (142) -- Statistical Data (110) -- Collected Works - General (020)
EDRS PRICE	MF01/PC10 Plus Postage.
DESCRIPTORS	Comparative Analysis; Data Collection; Family Environment; Foreign Countries; Grade 7; Grade 8; International Education; *International Studies; Junior High Schools; *Mathematics Achievement; Mathematics Tests; *Middle Schools; Performance Factors; Questionnaires; Reliability; Research Methodology; Sampling; Scoring; Sex Differences; Tables (Data); Test Construction; *Test Results; Translation
IDENTIFIERS	International Assn Evaluation Educ Achievement; Middle School Students; *Third International Mathematics and Science Study

ABSTRACT

The Third International Mathematics and Science Study (TIMSS) is the largest and most ambitious study undertaken by the International Association for the Evaluation of Educational Achievement. Forty-five countries collected data in more than 30 languages. Five grade levels were tested in the two subject areas, so that more than half a million students were tested around the world. This report addresses middle-school mathematics achievement (grades seven and eight) in six content areas: (1) fractions and number sense; (2) measurement; (3) proportionality; (4) data representation, analysis, and probability; (5) geometry; and (6) algebra. Results cover 41 countries with complete data collection. Singapore was the top-performing country at both grade levels, with Korea, Japan, and Hong Kong also performing very well. There were large differences in average achievement between top performers and bottom performing nations. Gender differences in mathematics achievement were small or nearly nonexistent in most countries, but when they did appear, they favored boys. In nearly every country there was a strong positive relationship between student enjoyment of mathematics and higher achievement. Home factors were strongly related to mathematics achievement in every participating country, but relationships between instructional variables and achievement were less clear. In every country, the pattern was for the eighth grade student whose parents had more education to also have higher achievement in mathematics. The amount of television viewing was negatively associated with mathematics achievement. The document's introduction provides information on each country's characteristics including demographics, public expenditures on education, organization of educational system. Chapters address: (1) International Student Achievement in Mathematics; (2) Average Achievement; (3) Performance on Items within Each Mathematics Content Area; (4) Students Backgrounds and Attitudes towards Mathematics; and (5) Teachers and Instruction. Appendixes include: Overview of TIMSS Procedures; Test-Curriculum Matching Analysis; Selected Mathematics Achievement Eighth-Grade Results for the Philippines, Denmark, Sweden, and German-Speaking Switzerland; and Percentiles and Standard Deviations of Mathematics Achievement. (SLD)

TIMSS

ED 406 419

Mathematics Achievement in the Middle School Years

Third
International
Mathematics
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Educational Achievement

MATHEMATICS ACHIEVEMENT IN THE MIDDLE SCHOOL YEARS: IEA'S THIRD INTERNATIONAL MATHEMATICS AND SCIENCE STUDY (TIMSS)

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November 1996

TIMSS International Study Center
Boston College
Chestnut Hill, MA, USA

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Mathematics Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study / by Albert E. Beaton, Ina V.S. Mullis, Michael O. Martin, Eugenio J. Gonzalez, Dana L. Kelly, and Teresa A. Smith

Publisher: Center for the Study of Testing, Evaluation, and Educational Policy,
Boston College.

Library of Congress Catalog Card Number: 96-71251

ISBN 1-889938-02-5

For more information about TIMSS contact:

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For information on ordering this report, write the above address or call +1-617-552-4521.

This report also is available on the World Wide Web:
http://wwwcsteep.bc.edu/timss

Funding for the international coordination of TIMSS is provided by the U.S. National Center for Education Statistics, the U.S. National Science Foundation, the IEA, and the Canadian government. Each participating country provides funding for the national implementation of TIMSS.

Boston College is an equal opportunity, affirmative action employer.

Printed and bound in the United States.

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Executive Summary

Since its inception in 1959, the International Association for the Evaluation of Educational Achievement (IEA) has conducted a series of international comparative studies designed to provide policy makers, educators, researchers, and practitioners with information about educational achievement and learning contexts. The Third International Mathematics and Science Study (TIMSS) is the largest and most ambitious of these studies ever undertaken.

The scope and complexity of TIMSS is enormous. Forty-five countries collected data in more than 30 different languages. Five grade levels were tested in the two subject areas, totaling more than half a million students tested around the world. The success of TIMSS depended on a collaborative effort between the research centers in each country responsible for implementing the steps of the project and the network of centers responsible for managing the across-country tasks such as training country representatives in standardized procedures, selecting comparable samples of schools and students, and conducting the various steps required for data processing and analysis. Including the administrators in the approximately 15,000 schools involved, many thousands of individuals around the world were involved in the data collection effort. Most countries collected their data in May and June of 1995, although those countries on a southern hemisphere schedule tested in late 1994, which was the end of their school year.

Six content dimensions were covered in the TIMSS mathematics tests given to the middle-school students: fractions and number sense; measurement; proportionality; data representation, analysis, and probability; geometry; and algebra. About one-fourth of the questions were in the free-responses format requiring students to generate and write their answers. These types of questions, some of which required extended responses, were allotted approximately one-third of the testing time. Chapter 3 of this report contains 33 example items illustrating the range of mathematics concepts and processes addressed by the TIMSS test.

Because the home, school, and national contexts within which education takes place can play important roles in how students learn mathematics, TIMSS collected extensive information about such background factors. The students who participated in TIMSS completed questionnaires about their home and school experiences related to learning mathematics. Also, teachers and school administrators completed questionnaires about instructional practices. System-level information was provided by each participating country.

TIMSS was conducted with attention to quality at every step of the way. Rigorous procedures were designed specifically to translate the tests, and numerous regional training sessions were held in data collection and scoring procedures. Quality control monitors observed testing sessions, and sent reports back to the TIMSS International Study Center at Boston College. The samples of students selected for testing were scrutinized according to rigorous standards designed to prevent bias and ensure comparability. In this publication, the countries are grouped for reporting of achievement according to their compliance with the sampling guidelines and the level of their participation rates. Prior to analysis, the data from each country were subjected to exhaustive checks for adherence to the international formats as well as for within-country consistency and comparability across countries.

The results provided in this report describe students' mathematics achievement at both the seventh and eighth grades. For most, but not all TIMSS countries, the two grades tested at the middle-school level represented the seventh and eighth years of formal schooling. Special emphasis is placed on the eighth-grade results, including selected information about students' background experiences and teachers' classroom practices in mathematics. Results are reported for the 41 countries that completed all of the steps on the schedule necessary to appear in this report. The results for students in the third and fourth grades, and for those in their final year of secondary school will appear in subsequent reports.

The following sections summarize the major findings described in this report.

STUDENTS' MATHEMATICS ACHIEVEMENT

- Singapore was the top-performing country at both the eighth and seventh grades. Korea, Japan, and Hong Kong also performed very well at both grades as did Flemish-speaking Belgium and the Czech Republic. Lower-performing countries included Colombia, Kuwait, and South Africa (see Tables 1.1 and 1.2; Figures 1.1 and 1.2).

- Perhaps the most striking finding was the large difference in average achievement between the top-performing and bottom-performing countries. Despite this large difference, when countries were ordered by average achievementt there were only small or negligible differences in achievement between one country and the one with the next-lowest average achievement. In some sense, at both grades, the results provide a chain of overlapping performances, where most countries had average achievement similar to a cluster of other countries, but from the beginning to the end of the chain there were substantial differences. For example, at both grades, average achievement in top-performing Singapore was comparable to or even exceeded performance for 95% of the students in the lowest-performing countries.

- For most countries, gender differences in mathematics achievement were small or essentially non-existent. However, the direction of the gender differences that did exist favored boys rather than girls. Similarly, within the mathematics content areas, there were few differences in performance between boys and girls. Again, the few differences that did occur favored boys (except in algebra, where, if anything, the differences favored girls).

- Compared to their overall performance in mathematics, nearly all countries did relatively better in several content areas than they did in others. Consistent with the idea of countries having different emphases in curriculum, those that performed relatively better in fractions and number sense tended to be different from those that performed relatively better in geometry and algebra.

- Even though students in the top-performing countries had very high achievement on many of the test questions, both seventh and eighth graders, in most countries, had difficulty with multi-step problem solving and applications. For example, students were asked to actually draw a new rectangle whose length was one and one-half times the length of a given rectangle and whose width was half the width of that rectangle. In only two countries (Korea and Austria) did at least half the eighth-grade students correctly draw the new rectangle.

- Students also found the proportionality items difficult. For example, one of the least difficult problems in this area asked about adding 5 girls and 5 boys to a class that was three-fifths girls. On average, fewer than two-thirds of the students across countries correctly answered that there would still be more girls than boys in the class.

- In algebra, 58% of the eighth-grade students across countries, on average, identified $4m$ as being equivalent to $m + m + m + m$. There was however, a very large range in performance from country to country. Seventy-five percent or more of the eighth graders answered this question correctly in the Czech Republic, Hong Kong, Japan, the Russian Federation, Singapore, the Slovak Republic, and Slovenia.

STUDENTS' ATTITUDES TOWARDS MATHEMATICS

- Within nearly every country, a clear positive relationship was observed between a stronger liking of mathematics and higher achievement. Even though the majority of eighth graders in nearly every country indicated they liked mathematics to some degree, clearly not all students feel positive about this subject area. In Austria, the Czech Republic, Germany, Hungary, Japan, Korea, Lithuania, and the Netherlands, more than 40% of the students reported disliking mathematics.

- In no country, did eighth-grade girls report a stronger liking of mathematics than did boys. However, boys reported liking mathematics better than girls did in several countries, including Austria, France, Germany, Hong Kong, Japan, Norway, and Switzerland.

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- In all except four countries, the majority of students agreed or strongly agreed that they did well in mathematics – a perception that did not always coincide with the comparisons in achievement across countries on the TIMSS test. Interestingly, the exceptions included three of the highest performing countries – Hong Kong, Japan, and Korea – where more than 50% of the students disagreed or strongly disagreed about doing well (the fourth was Lithuania). It should be noted, however, that within nearly all countries there was a clear relationship between perception and performance, with those students reporting higher self-perceptions of doing well in mathematics also having higher average achievement.

- Internationally, the most frequently cited reason for needing to do well in mathematics was to get into students' desired secondary school or university.

HOME ENVIRONMENT

Home factors were strongly related to mathematics achievement in every country that participated in TIMSS.

- In every country, eighth-grade students who reported having more educational resources in the home had higher mathematics achievement than those who reported little access to such resources. Strong positive relationships were found between mathematics achievement and having study aids in the home, including a dictionary, a computer, and a study desk/table for the student's own use.

- The number of books in the home can be an indicator of a home environment that values and provides general academic support. In most TIMSS countries, the more books students reported in the home, the higher their mathematics achievement.

- In every country, the pattern was for the eighth-grade students whose parents had more education to also have higher achievement in mathematics.

- Beyond the one to two hours of daily television viewing reported by close to the majority of eighth graders in all participating countries, the amount of television students watched was negatively associated with mathematics achievement.

- In most countries, eighth graders reported spending as much out-of-school time each day in non-academic activities as they did in academic activities. Besides watching television, students reported spending several hours, on average, each day playing or talking with friends, and nearly two hours playing sports. (It should be noted, however, the time spent in these activities is not additive because students can talk with their friends at sporting events or while watching TV, for example.)

INSTRUCTIONAL CONTEXTS AND PRACTICES

In comparison to the positive relationships observed between mathematics achievement and home factors, the relationships were less clear between achievement and various instructional variables, both within and across countries. Obviously, educational policies and practices such as tracking and streaming serve to systematically confound these relationships. Also, the interaction among instructional variables can be extremely complex and merits further study.

- The qualifications required for teaching certification were relatively uniform across countries. Most countries reported that four years of post-secondary education were required, even though there was a range from two to six years. Almost all countries reported that teaching practice was a requirement, as was an examination or evaluation.

- Teachers in most countries reported that mathematics classes typically meet for at least two hours a week, but less than three and one-half hours. Weekly instructional time of from three and one-half hours up to five hours also was common for a number of countries. The data, however, revealed no clear pattern between the number of in-class instructional hours and mathematics achievement.

- There was considerable variation in class size. In a number of countries, nearly all students (90% or more) were in classes of fewer than 30 students. At the other end of the spectrum, 93% of the students in Korea were in classes with more than 40 students. The TIMSS data showed different patterns of mathematics achievement in relation to class size for different countries.

- Small-group work was used less frequently than other instructional approaches. Across countries, mathematics teachers reported that working together as a class with the teacher teaching the whole class, and having students work individually with assistance from the teacher were the most frequently used instructional approaches.

- In most participating countries, teachers reported using a textbook in teaching mathematics for 95% or more of the students. Relatively uniformly, the majority of students were asked both to practice computation and do some type of reasoning tasks in most or every lesson.

- Regarding the use of technology, teachers in many countries reported three-fourths or more of the eighth graders used calculators almost every day in their mathematics classes, often for checking answers, routine computation, and solving complex problems. An exception was Korea, where it was reported that calculators were seldom used. Teachers and students agreed that the computer was almost never used in most students' mathematics lessons.

- Eighth graders in about half the countries reported doing an average of two to three hours per day of homework, with those in many countries reporting studying mathematics for roughly an hour each day. There was a range from half an hour to two hours per day spent on mathematics homework and about two to five hours overall, but the relationship between amount of homework done and level of mathematics achievement was inconsistent.

- Eighth-grade students reported substantial variation in the frequency of testing in mathematics classes. In a number of countries, the majority of the eighth-grade students reported having quizzes and tests only once in while or never. In contrast, one-third or more of the students reported almost always having quizzes or tests in Colombia, Hong Kong, Kuwait, Romania, Spain, and the United States.

Introduction

As the 21st century approaches, technology is having more and more impact on the daily lives of individuals throughout the world. It influences our receipt of news and information, how we spend our leisure time, and where we work. At an ever-increasing pace, technology also is becoming a major factor in determining the economic health of countries. To ensure their economic well-being, countries will need citizens prepared to participate in "brain-power" industries such as micro-electronics, computers, and telecommunications. The young adolescents of today will be seeking jobs in a global economy requiring levels of technical competence and flexible thinking that were required by only a few workers in the past. To make sensible decisions and participate effectively in a world transformed by the ability to exchange all types of information almost instantly, these students will need to be well educated in a number of core areas, especially mathematics and science.

The fact that skills in mathematics and science are so critical to economic progress in a technologically-based society has led countries to seek information about what their school-age populations know and can do in mathematics and science. There is interest in what concepts students understand, how well they can apply their knowledge to problem-solving situations, and whether they can communicate their understandings. Even more vital, countries are desirous of furthering their knowledge about what can be done to improve students' understanding of mathematical concepts, their ability to solve problems, and their attitudes toward learning.

The Third International Mathematics and Science Study (TIMSS) provided countries with a vehicle for investigating these issues while expanding their perspectives of what is possible beyond the confines of their national borders. It is the most ambitious and complex comparative education study in a series of such undertakings conducted during the past 37 years by the International Association for the Evaluation of Educational Achievement (IEA).[1] The main purpose of TIMSS was to focus on educational policies, practices, and outcomes in order to enhance mathematics and science learning within and across systems of education.

With its wealth of information covering more than half a million students at five grade levels in 15,000 schools and more than 40 countries around the world, TIMSS offers an unprecedented opportunity to examine similarities and differences in how mathematics and science education works and how well it works. The study used innovative testing approaches and collected extensive information about the contexts within which students learn mathematics and science.

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[1] The previous IEA mathematics studies were conducted in 1964 and 1980-82, and the science studies in 1970-71 and 1983-84. For information about TIMSS procedures, see Appendix A.

The present report focuses on the mathematics achievement of students in the two grades with the largest proportion of 13-year-olds – the seventh and eighth grades in most countries. Special emphasis is placed on the eighth-grade results, including selected information about students' background and classroom practices in teaching mathematics.

All countries that participated in TIMSS were to test students in the two grades with the largest proportion of 13-year-olds in both mathematics and science. A companion report, *Science Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study (TIMSS)*,[2] presents corresponding results about students' science achievement.

Many TIMSS countries also tested the mathematics and science achievement of students in the two grades with the largest proportion of 9-year-olds (third and fourth grades in most countries) and of students in their final year of secondary education. Subsets of students, except the final-year students, also had the opportunity to participate in a "hands-on" performance assessment where they designed experiments and tested hypotheses. The results of these components of TIMSS will be presented in forthcoming reports.

Together with the achievement tests, TIMSS administered a broad array of background questionnaires. The data collected from students, teachers, and school principals, as well as the system-level information collected from the participating countries, provide an abundance of information for further study and research. TIMSS data make it possible to examine differences in current levels of performance in relation to a wide variety of variables associated with classroom, school, and national contexts within which education takes place.

WHICH COUNTRIES PARTICIPATED?

TIMSS was very much a collaborative process among countries. Table 1 shows the 45 participating countries. Each participant designated a national center to conduct the activities of the study and a National Research Coordinator (NRC) to assume responsibility for the successful completion of these tasks.[3] For the sake of comparability, all testing was conducted at the end of the school year. The four countries on a Southern Hemisphere school schedule (Australia, Korea, New Zealand, and Singapore) tested in September through November of 1994, which was the end of the school year in the Southern Hemisphere. The remaining countries tested the mathematics and science achievement of their students at the end of the 1994-95 school year, most often in May and June of 1995. Because Argentina, Italy, and Indonesia were unable to complete the steps necessary to appear in this report, the tables throughout the report do not include data for these three countries. Results also are not presented for Mexico, which chose not to release its seventh- and eighth-grade results in the international reports.

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[2] Beaton, A.E., Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Smith, T.A., and Kelly, D.L. (1996). *Science Achievement in the Middle School Years: IEA's Third International Mathematics and Science Study (TIMSS)*. Chestnut Hill, MA: Boston College.

[3] Appendix F lists the National Research Coordinators as well as the members of the TIMSS advisory committees.

Table 1

Countries Participating in TIMSS[1]

- Argentina
- Australia
- Austria
- Belgium *
- Bulgaria
- Canada
- Colombia
- Cyprus
- Czech Republic
- Denmark
- England
- France
- Germany
- Greece
- Hong Kong
- Hungary
- Iceland
- Indonesia
- Iran, Islamic Republic
- Ireland
- Israel
- Italy
- Japan
- Korea, Republic of
- Kuwait
- Latvia
- Lithuania
- Mexico
- Netherlands
- New Zealand
- Norway
- Philippines
- Portugal
- Romania
- Russian Federation
- Scotland
- Singapore
- Slovak Republic
- Slovenia
- South Africa
- Spain
- Sweden
- Switzerland
- Thailand
- United States

* The Flemish and French educational systems in Belgium participated separately.

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[1] Argentina, Italy, and Indonesia were unable to complete the steps necessary for their data to appear in this report. Because the characteristics of its school sample are not completely known, achievement results for the Philippines are presented in Appendix C. Mexico participated in the testing portion of TIMSS, but chose not to release its results at grades 7 and 8 in the international report.

Table 2 shows information about the lower and upper grades tested in each country, including the country names for those two grades and the years of formal schooling students in those grades had completed when they were tested for TIMSS. Table 2 reveals that for most, but not all, countries, the two grades tested represented the seventh and eighth years of formal schooling. Thus, solely for convenience, the report often refers to the upper grade tested as the eighth grade and the lower grade tested as the seventh grade. As a point of interest, a system-split (where the lower grade was in upper primary and the upper grade was in lower secondary) occurred in six countries: New Zealand, Norway, the Philippines, South Africa, Sweden, and Switzerland. Two countries, Israel and Kuwait, tested only at the upper grade.

Having valid and efficient samples in each country is crucial to the quality and success of any international comparative study. The accuracy of the survey results depends on the quality of sampling information available, and particularly on the quality of the samples. TIMSS developed procedures and guidelines to ensure that the national samples were of the highest quality possible. Standards for coverage of the target population, participation rates, and the age of students were established, as were clearly documented procedures on how to obtain the national samples. For the most part, the national samples were drawn in accordance with the TIMSS standards, and achievement results can be compared with confidence. However, despite efforts to meet the TIMSS specifications, some countries did not do so. These countries are specially annotated and/or shown in separate sections of the tables in this report.[4]

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[4] The TIMSS sampling requirements and the outcomes of the sampling procedures are described in Appendix A.

Table 2

Information About the Grades Tested

Country	Lower Grade		Upper Grade	
	Country's Name for Lower Grade	Years of Formal Schooling Including Lower Grade[1]	Country's Name for Upper Grade	Years of Formal Schooling Including Upper Grade[1]
[2] Australia	7 or 8	7 or 8	8 or 9	8 or 9
Austria	3. Klasse	7	4. Klasse	8
Belgium (Fl)	1A	7	2A & 2P	8
Belgium (Fr)	1A	7	2A & 2P	8
Bulgaria	7	7	8	8
Canada	7	7	8	8
Colombia	7	7	8	8
Cyprus	7	7	8	8
Czech Republic	7	7	8	8
Denmark	6	6	7	7
England	Year 8	8	Year 9	9
France	5eme	7	4eme (90%) or 4eme Technologique (10%)	8
Germany	7	7	8	8
Greece	Secondary 1	7	Secondary 2	8
Hong Kong	Secondary 1	7	Secondary 2	8
Hungary	7	7	8	8
Iceland	7	7	8	8
Iran, Islamic Rep.	7	7	8	8
Ireland	1st Year	7	2nd Year	8
Israel	–	–	8	8
Japan	1st Grade Lower Secondary	7	2nd Grade Lower Secondary	8
Korea, Republic of	1st Grade Middle School	7	2nd Grade Middle School	8
Kuwait	–	–	9	9
Latvia	7	7	8	8
Lithuania	7	7	8	8
Netherlands	Secondary 1	7	Secondary 2	8
[3,4] New Zealand	Form 2	7.5 - 8.5	Form 3	8.5 - 9.5
[3] Norway	6	6	7	7
[3] Philippines	Grade 6 Elementary	6	1st Year High School	7
Portugal	Grade 7	7	Grade 8	8
Romania	7	7	8	8
[5] Russian Federation	7	6 or 7	8	7 or 8
Scotland	Secondary 1	8	Secondary 2	9
Singapore	Secondary 1	7	Secondary 2	8
Slovak Republic	7	7	8	8
Slovenia	7	7	8	8
Spain	7 EGB	7	8 EGB	8
[3] South Africa	Standard 5	7	Standard 6	8
[3] Sweden	6	6	7	7
[3] Switzerland				
(German)	6	6	7	7
(French and Italian)	7	7	8	8
Thailand	Secondary 1	7	Secondary 2	8
United States	7	7	8	8

---

[1] Years of schooling based on the number of years children in the grade level have been in formal schooling, beginning with primary education (International Standard Classification of Education Level 1). Does not include preprimary education.

[2] Australia: Each state/territory has its own policy regarding age of entry to primary school. In 4 of the 8 states/territories students were sampled from grades 7 and 8; in the other four states/territories students were sampled from grades 8 and 9.

[3] Indicates that there is a system-split between the lower and upper grades. In Switzerland there is a system-split in 14 of 26 cantons.

[4] New Zealand: The majority of students begin primary school on or near their 5th birthday so the "years of formal schooling" vary.

[5] Russian Federation: 70% of students in the seventh grade have had 6 years of formal schooling; 70% in the eighth grade have had 7 years of formal schooling.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Information provided by TIMSS National Research Coordinators.

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What Was the Nature of the Mathematics Test?

Together with the quality of the samples, the quality of the test also receives considerable scrutiny in any comparative study. All participants wish to ensure that the achievement items are appropriate for their students and reflect their current curriculum. Developing the TIMSS tests was a cooperative venture involving all of the NRCs during the entire process. Through a series of efforts, countries submitted items that were reviewed by mathematics subject-matter specialists, and additional items were written to ensure that the desired mathematics topics were covered adequately. Items were piloted, the results reviewed, and new items were written and piloted. The resulting TIMSS mathematics test contained 151 items representing a range of mathematics topics and skills.

The TIMSS curriculum frameworks described the content dimensions for the TIMSS tests as well as performance expectations (behaviors that might be expected of students in school mathematics).[5] Six content areas are covered in the mathematics test taken by seventh- and eighth-grade students. These areas and the percentage of the test items devoted to each include: fractions and number sense (34%); measurement (12%); proportionality (7%); data representation, analysis, and probability (14%); geometry (15%); and algebra (18%). The performance expectations include: knowing (22%); performing routine procedures (25%); using complex procedures (21%); and solving problems (32%).

About one-fourth of the questions were in the free-response format, requiring students to generate and write their answers. These questions, some of which required extended responses, were allotted approximately one-third of the testing time. Responses to the free-response questions were evaluated to capture diagnostic information, and some were scored using procedures that permitted partial credit.[6] Chapter 3 of this report contains 33 example items illustrating the range of mathematics concepts and processes addressed by the TIMSS test.

The TIMSS tests were prepared in English and translated into 30 additional languages using explicit guidelines and procedures. A series of verification checks were conducted to ensure the comparability of the translations.[7]

The tests were given so that no one student took all of the items, which would have required more than three hours. Instead, the test was assembled in eight booklets, each requiring 90 minutes to complete. Each student took only one booklet, and the items were rotated through the booklets so that each one was answered by a representative sample of students.

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[5] Robitaille, D.F., McKnight, C.C., Schmidt, W.H., Britton, E.D., Raizen, S.A., and Nicol, C. (1993). *TIMSS Monograph No. 1: Curriculum Frameworks for Mathematics and Science.* Vancouver, B.C.: Pacific Educational Press.

[6] TIMSS scoring reliability studies within and across countries indicate that the percent of exact agreement for correctness scores averaged well above 90%. For more details, see Appendix A.

[7] See Appendix A for more information about the translation procedures.

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TIMSS conducted a Test-Curriculum Matching Analysis whereby countries examined the TIMSS test to identify items measuring topics not addressed in their curricula. The analysis showed that omitting such items for each country had little effect on the overall pattern of achievement results across all countries.[8]

HOW DO COUNTRY CHARACTERISTICS DIFFER?

International studies of student achievement provide valuable comparative information about student performance and instructional practices. Along with the benefits of international studies, though, are challenges associated with comparing achievement across countries, cultures, and languages. In TIMSS, extensive efforts were made to attend to these issues through careful planning and documentation, cooperation among the participating countries, standardized procedures, and rigorous attention to quality control throughout.[9]

Beyond the integrity of the study procedures, the results of comparative studies such as TIMSS also need to be considered in light of the larger contexts in which students are educated and the kinds of system-wide factors that might influence students' opportunity to learn. A number of these factors are more fully described in *National Contexts for Mathematics and Science Education: An Encyclopedia of the Education Systems Participating in TIMSS*;[10] however, some selected demographic characteristics of the TIMSS countries are presented in Table 3. Table 4 contains information about public expenditure on education. The information in these two tables shows that some of the TIMSS countries are densely populated and others are more rural, some are large and some small, and some expend considerably more resources on education than others. Although these factors do not necessarily determine high or low performance in mathematics, they do provide a context for considering the difficulty of the educational task from country to country.

Describing students' educational opportunities also includes understanding the knowledge and skills that students are supposed to master. To help complete the picture of educational practices in the TIMSS countries, mathematics and curriculum specialists within each country provided detailed categorizations of their curriculum guides, textbooks, and curricular materials. The initial results from this effort can be found in two reports, entitled *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Mathematics* and *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Science*.[11]

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[8] Results of the Test-Curriculum Matching Analysis are presented in Appendix B.

[9] Appendix A contains an overview of the procedures used and cites a number of references providing details about TIMSS methodology.

[10] Robitaille D.F. (in press). *National Contexts for Mathematics and Science Education: An Encyclopedia of the Education Systems Participating in TIMSS*. Vancouver, B.C.: Pacific Educational Press.

[11] Schmidt, W.H., McKnight, C.C., Valverde, G. A., Houang, R.T., and Wiley, D. E. (in press). *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Mathematics*. Dordrecht, the Netherlands: Kluwer Academic Publishers. Schmidt, W.H., Raizen, S.A., Britton, E.D., Bianchi, L.J., and Wolfe, R.G. (in press). *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Science*. Dordrecht, the Netherlands: Kluwer Academic Publishers.

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Table 3

Selected Demographic Characteristics of TIMSS Countries

Country	Population Size (1,000)[1]	Area of Country (1000 Square Kilometers)[2]	Density (Population per Square Kilometer)[3]	Percentage of Population Living in Urban Areas	Life Expectancy[4]	Percent in Secondary School[5]
Australia	**17843**	**7713**	**2.29**	**84.8**	**77**	**84**
Austria	8028	84	95.28	55.5	77	107
Belgium	10116	31	330.40	96.9	76	103
Bulgaria	8435	111	76.39	70.1	71	68
Canada	29248	9976	2.90	76.7	78	88
Colombia	36330	1139	31.33	72.2	70	62
Cyprus	726	9	77.62	53.6	77	95
Czech Republic	10333	79	130.99	65.3	73	86
Denmark	5205	43	120.42	85.1	75	114
[6] England	48533	130	373.33	–	77	–
France	57928	552	104.56	72.8	78	106
Germany	81516	357	227.39	86.3	76	101
Greece	10426	132	78.63	64.7	78	99
[7] Hong Kong	6061	1	5691.35	94.8	78	98
Hungary	10261	93	110.03	64.2	70	81
Iceland	266	103	2.56	91.4	79	103
Iran	62550	1648	36.98	58.5	68	66
Ireland	3571	70	50.70	57.4	76	105
Israel	5383	21	252.14	90.5	77	87
Japan	124961	378	329.63	77.5	79	96
Korea, Republic of	44453	99	444.92	79.8	71	93
Kuwait	1620	18	80.42	96.8	76	60
Latvia	2547	65	40.09	72.6	68	87
Lithuania	3721	65	57.21	71.4	69	78
Netherlands	15381	37	409.30	88.9	78	93
New Zealand	3493	271	12.78	85.8	76	104
Norway	4337	324	13.31	73.0	78	116
Philippines	67038	300	218.83	53.1	65	79
Portugal	9902	92	106.95	35.2	75	81
Romania	22731	238	95.81	55.0	70	82
Russian Federation	148350	17075	8.70	73.2	64	88
[8] Scotland	5132	79	65.15	–	75	–
Singapore	2930	1	4635.48	100.0	75	84
Slovak Republic	5347	49	108.61	58.3	72	89
Slovenia	1989	20	97.14	62.7	74	85
South Africa	40539	1221	32.46	50.5	64	77
Spain	39143	505	77.43	76.3	77	113
Sweden	8781	450	19.38	83.1	78	99
Switzerland	6994	41	168.03	60.6	78	91
Thailand	58024	513	111.76	31.9	69	37
United States	260650	9809	27.56	76.0	77	97

[1] Estimates for 1994 based, in most cases, on a de facto definition. Refugees not permanently settled in the country of asylum are generally considered to be part of their country of origin.

[2] Area is the total surface area in square kilometers, comprising all land area and inland waters.

[3] Density is population per square kilometer of total surface area.

[4] Number of years a newborn infant would live if prevailing patterns of mortality at its birth were to stay the same throughout its life.

[5] Gross enrollment of all ages at the secondary level as a percentage of school-age children as defined by each country. This may be reported in excess of 100% if some pupils are younger or older than the country's standard range of secondary school age.

[6] Annual Abstract of Statistics1995, and Office of National Statistics. All data are for 1993.

[7] Number for Secondary Enrollment is from Education Department (1985) Education Indicators for the Hong Kong Education System (unpublished document).

[8] Registrar General for Scotland Annual Report 1995 and Scottish Abstract of Statistics 1993.

(–) A dash indicates the data were unavailable.

SOURCE: The World Bank, Social Indicators of Development, 1996.

Table 4

Public Expenditure on Education at Primary and Secondary Levels[1] in TIMSS Countries

Country	Gross National Product per Capita (US Dollars)	Gross National Product per Capita (Intl. Dollars)	Public Expenditure on Education (Levels 1 & 2) as % of Gross National Product[4]	Public Expenditure on Education (Intl. Dollars per Capita)
Australia	17980	19000	3.69	701
Austria	24950	20230	4.24	858
Belgium	22920	20450	3.70	757
Bulgaria	1160	4230	3.06	129
Canada	19570	21230	4.62	981
Colombia	1620	5970	2.83	169
Cyprus[6]	10380	–	3.60	–
Czech Republic	3210	7910	3.75	297
Denmark	28110	20800	4.80	998
England[7]	18410	18170	3.57	649
France	23470	19820	3.61	716
Germany	25580	19890	2.43	483
Greece	7710	11400	2.27	259
Hong Kong[8]	21650	23080	1.34	309
Hungary	3840	6310	4.31	272
Iceland	24590	18900	4.77	902
Iran	–	4650	3.93	183
Ireland	13630	14550	4.21	613
Israel	14410	15690	3.72	584
Japan	34360	21350	2.82	602
Korea, Republic of	8220	10540	3.43	362
Kuwait	19040	24500	3.46	848
Latvia	2290	5170	2.85	147
Lithuania	1350	3240	2.18	71
Netherlands	21970	18080	3.30	597
New Zealand	13190	16780	3.15	529
Norway	26480	21120	5.26	1111
Philippines	960	2800	1.78	50
Portugal	9370	12400	2.98	370
Romania	1230	2920	1.89	55
Russian Federation	2650	5260	–	–
Scotland	18410	18170	3.57	649
Singapore	23360	21430	3.38	724
Slovak Republic	2230	6660	2.69	179
Slovenia	7140	–	4.20	–
South Africa	3010	–	5.12	–
Spain	13280	14040	3.17	445
Sweden	23630	17850	4.92	878
Switzerland	37180	24390	3.72	907
Thailand	2210	6870	3.00	206
United States	25860	25860	4.02	1040

[1] The levels of education are based on the International Standard Classification of Education. The duration of Primary (level 1) and Secondary (level 2) vary depending on the country.

[2] SOURCE: The World Bank Atlas, 1996. Estimates for 1994 at current market prices in U.S. dollars, calculated by the conversion method used for the World Bank Atlas.

[3] SOURCE: The World Bank Atlas, 1996. Converted at purchasing power parity (PPP). PPP is defined as number of units of a country's currency required to buy same amounts of goods and services in domestic market as one dollar would buy in the United States.

[4] SOURCE: UNESCO Statistical Yearbook, 1995. Calculated by multiplying the Public Expenditure on Education as a % of GNP by the percentage of public education expenditure on the first and second levels of education. Figures represent the most recent figures released.

[5] Calculated by multiplying the GNP per Capita (Intl. Dollars) column by Public Expenditure on Education.

[6] GNP per capita figure for Cyprus is for 1993.

[7] The figures for England and Scotland are for the United Kingdom.

[8] Calculated using Education Department (1985) Education Indicators for the Hong Kong Education System (unpublished document).

(–) A dash indicates the data were unavailable.

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Depending on the educational system, students' learning goals are commonly set at one of three main levels: the national or regional level, the school level, or the classroom level. Some countries are highly centralized, with the ministry of education (or highest authority in the system) having exclusive responsibility for making the major decisions governing the direction of education. In others, such decisions are made regionally or locally. Each approach has its strengths and weaknesses. Centralized decision making can add coherence in curriculum coverage, but may constrain a school or teacher's flexibility in tailoring instruction to the different needs of students.

Figures 1, 2, and 3 show the degree of centralization in the TIMSS countries regarding decision-making about curriculum syllabi, textbooks, and examinations. Thirty of the TIMSS participants reported nationally-centralized decision-making about curriculum. Fewer countries reported nationally-centralized decision-making about textbooks, although 16 participants were in this category. Thirteen countries reported nationally-centralized decision-making about examinations. Regional decision-making about these three aspects of education does not appear very common among the TIMSS countries, with only a few countries reporting this level of decision-making for curriculum syllabi and textbooks, and none reporting it for examinations.

Most countries reported having centralized decision-making for one or two of the areas and "not centralized" decision-making for one or two of the areas. However, six countries – Bulgaria, Hong Kong, Lithuania, the Philippines, Romania, and Singapore – reported nationally-centralized decision-making for all three areas: curriculum syllabi, textbooks, and examinations. Six countries – Australia, Hungary, Iceland, Latvia, Scotland, and the United States – reported that decision-making is not centralized for any of these areas.

Figure 1

Centralization of Decision-Making Regarding Curriculum Syllabi

Criteria

Countries are in the "Nationally Centralized" category regarding curriculum if the highest level of decision-making authority within the educational system (e.g., the ministry of education) has exclusive responsibility for or gives final approval of the syllabi for courses of study. If curriculum syllabi are determined at the regional level (e.g., state, province, territory), a country is in the "Regionally Centralized" Category. If syllabi for courses of study are not determined nationally or regionally, a country is in the "Not Centralized" category.

Nationally Centralized

Austria
Belgium (Fl)[1]
Belgium (Fr)[1]
Bulgaria
Colombia
Cyprus
Czech Republic
England
France
Greece
Hong Kong
Iran, Islamic Rep.
Ireland
Israel
Japan
Korea
Kuwait
Lithuania
New Zealand
Norway[2]
Philippines
Portugal
Romania
Singapore
Slovak Republic
Slovenia
South Africa
Spain[3]
Sweden[4]
Thailand

Regionally Centralized

Canada
Germany
Switzerland[5]

Not Centralized

Australia[6]
Denmark[7]
Hungary[8]
Iceland
Latvia
Netherlands[9]
Russian Federation
Scotland
United States

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[1] Belgium: In Belgium, decision-making is centralized separately for the two educational systems.

[2] Norway: The National Agency of Education provides goals which schools are required to work towards. Schools have the freedom to implement the goals based on local concerns.

[3] Spain: Spain is now reforming to a regionally centralized system with high responsibility at the school level.

[4] Sweden: The National Agency of Education provides goals which schools are required to work towards. Schools have the freedom to implement the goals based on local concerns.

[5] Switzerland: Decision-making regarding curricula in upper secondary varies across cantons and types of education.

[6] Australia: Students tested in TIMSS were educated under a decentralized system. Reforms beginning in 1994 are introducing regionally centralized (state-determined) curriculum guidelines.

[7] Denmark: The Danish Parliament makes decisions governing the overall aim of education, and the Minister of Education sets the target, the central knowledge, and proficiency for each subject and the grades for teaching the subject. The local school administration can implement the subjects from guidelines from the Ministry; however, these are recommendations and are not mandatory.

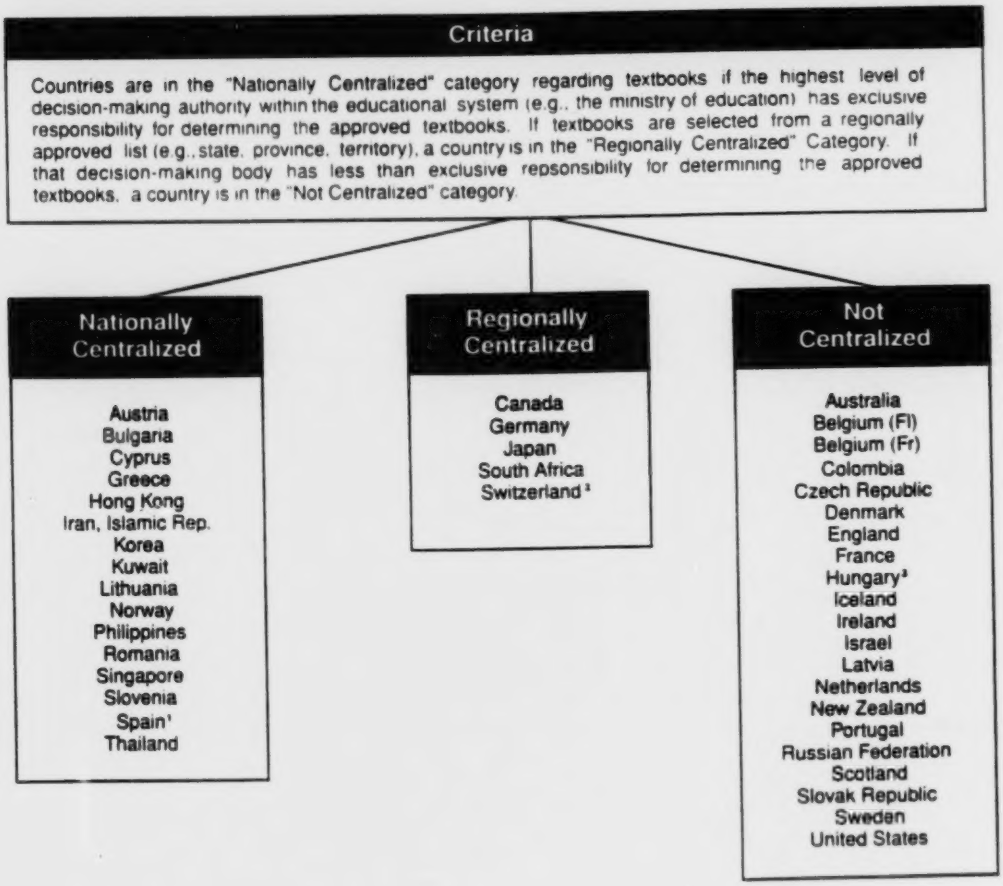
[8] Hungary: Hungary is in the midst of changing from a highly centralized system to one in which local authorities and schools have more autonomy.

[9] Netherlands: The Ministry of Education sets core objectives (for subjects in primary education and in 'basic education' at lower secondary level) and goals/objectives (for subjects in the four student ability tracks in secondary education) which schools are required to work towards. Schools have the freedom, though, to decide how to reach these objectives.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Information provided by TIMSS National Research Coordinators.

Figure 2

Centralization of Decision-Making Regarding Textbooks



Criteria

Countries are in the "Nationally Centralized" category regarding textbooks if the highest level of decision-making authority within the educational system (e.g., the ministry of education) has exclusive responsibility for determining the approved textbooks. If textbooks are selected from a regionally approved list (e.g., state, province, territory), a country is in the "Regionally Centralized" Category. If that decision-making body has less than exclusive repsonsibility for determining the approved textbooks, a country is in the "Not Centralized" category.

Nationally Centralized

Austria
Bulgaria
Cyprus
Greece
Hong Kong
Iran, Islamic Rep.
Korea
Kuwait
Lithuania
Norway
Philippines
Romania
Singapore
Slovenia
Spain[1]
Thailand

Regionally Centralized

Canada
Germany
Japan
South Africa
Switzerland[2]

Not Centralized

Australia
Belgium (Fl)
Belgium (Fr)
Colombia
Czech Republic
Denmark
England
France
Hungary[3]
Iceland
Ireland
Israel
Latvia
Netherlands
New Zealand
Portugal
Russian Federation
Scotland
Slovak Republic
Sweden
United States

---

[1] Spain: Spain is now reforming to a regionally centralized system with high responsibility at the school level.

[2] Switzerland: Decision-making regarding textbooks in upper secondary varies across the cantons and the types of education.

[3] Hungary: Hungary is in the midst of changing from a highly centralized system to one in which local authorities and schools have more autonomy.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Information provided by TIMSS National Research Coordinators.

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Figure 3

Centralization of Decision-Making Regarding Examinations

Criteria

Countries are in the "Nationally Centralized" category regarding examinations if the highest level of decision-making authority within the educational system (e.g., the ministry of education) has exclusive responsibility for or gives final approval of the content of examinations. The notes explain during which school years the examinations are administered. If that decision-making body has less than exclusive responsibility for or final approval of the examination content, the country is in the "Not Centralized" category.

Nationally Centralized

Bulgaria
Denmark[1]
England[2]
Hong Kong[3]
Ireland[4]
Lithuania
Netherlands[5]
New Zealand[6]
Philippines[7]
Romania
Russian Federation[8]
Singapore[9]
South Africa

Not Centralized

Australia[10]
Austria
Belgium (Fl)
Belgium (Fr)
Canada
Colombia
Cyprus
Czech Republic
France
Germany[11]
Greece
Hungary
Iceland
Iran, Islamic Rep.
Israel[12]
Japan
Korea
Kuwait
Latvia[13]
Norway
Portugal
Scotland
Singapore
Slovak Republic
Slovenia[14]
Spain
Sweden[15]
Switzerland
Thailand
United States

---

[1] Denmark: Written examinations are set and marked centrally. The Ministry of Education sets the rules and framework for oral examinations. However, oral examinations are conducted by the pupil's own teacher, together with a teacher from another local school or an external (ministry-appointed) examiner.

[2] England: Centralized national curriculum assessments taken at Years 2, 6 and 9. Regionally centralized examinations taken at Years 11 and 13.

[3] Hong Kong: Centralized examination taken at Year 11.

[4] Ireland: Centralized examinations taken at Grade 9 and Grade 12.

[5] Netherlands: School-leaving examinations consisting of a centralized part and a school bound part are taken in the final grades of the four student ability tracks in secondary education.

[6] New Zealand: Centralized examinations taken at Years 11, 12 and 13. Centralized national monitoring at Years 4 and 8.

[7] Philippines: Centralized examinations taken at Grade 6 and Year 10 (4th year high school).

[8] Russian Federation: Centralized examinations taken in Grades 9 and 11 in mathematics and Russian literature.

[9] Singapore: Centralized examinations taken at Grades 6, 10, and 12.

[10] Australia: Not centralized as a country, but low-stakes statewide population assessments are undertaken in most states at one or more of Grades 3, 5, 6 and 10. In most states, centralized examinations are taken at Grade 12.

[11] Germany: Not centralized as a country, but is centralized within 6 (of 16) federal states.

[12] Israel: Centralized examinations taken at the end of secondary school that affect opportunities for further education.

[13] Latvia: Centralized examinations taken at Grade 9 and Grade 12.

[14] Slovenia: Two-subject national examination taken after Grade 8 (end of compulsory education); five-subject externally assessed baccalaureat after Grade 12 for everyone entering university.

[15] Sweden: There are no examinations in Sweden.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Information provided by TIMSS National Research Coordinators.

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Chapter 1

INTERNATIONAL STUDENT ACHIEVEMENT IN MATHEMATICS

WHAT ARE THE OVERALL DIFFERENCES IN MATHEMATICS ACHIEVEMENT?

Chapter 1 summarizes achievement on the TIMSS mathematics test for each of the participating countries. Comparisons are provided overall and by gender for the upper grade tested (often the eighth grade) and the lower grade tested (often the seventh grade), as well as for 13-year-olds.

Table 1.1 presents the mean (or average) achievement for 41 countries at the eighth grade.[1] The 25 countries shown by decreasing order of mean achievement in the upper part of the table were judged to have met the TIMSS requirements for testing a representative sample of students. Although all countries tried very hard to meet the TIMSS sampling requirements, several encountered resistance from schools and teachers and did not have participation rates of 85% or higher as specified in the TIMSS guidelines (i.e., Australia, Austria, Belgium (French), Bulgaria, the Netherlands, and Scotland). To provide a better curricular match, four countries (i.e., Colombia, Germany, Romania, and Slovenia) elected to test their seventh- and eighth-grade students even though that meant not testing the two grades with the most 13-year-olds and led to their students being somewhat older than those in the other countries. The countries in the remaining two categories encountered various degrees of difficulty in implementing the prescribed methods for sampling classrooms within schools. Because the Philippines did not document clearly its procedures for sampling schools, its achievement results are presented in Appendix C. A full discussion of the sampling procedures and outcomes for each country can be found in Appendix A.

To aid in interpretation, the table also contains the years of formal schooling and average age of the students. Equivalence of chronological age does not necessarily mean that students have received the same number of years of formal schooling or studied the same curriculum. Most notably, students in the three Scandinavian countries, Sweden, Norway, and Denmark, had fewer years of formal schooling than their counterparts in other countries,[2] and those in England, Scotland, New Zealand, and Kuwait had more. Countries with a high percentage of older students may have policies that include retaining students in lower grades.

TIMSS used item response theory (IRT) methods to summarize the achievement results for both grades on a scale with a mean of 500 and a standard deviation of 100. Scaling averages students' responses to the subsets of items they took in a way that accounts for differences in the difficulty of those items. It allows students' performance to be summarized on a common metric even though individual students responded to different items in the mathematics test. For more detailed information, see the "IRT Scaling and Data Analysis" section of Appendix A.

Achievement results for the eighth-grade students in Denmark and Sweden, as well as for the eighth-grade students in German-speaking schools in Switzerland are presented in Appendix D.

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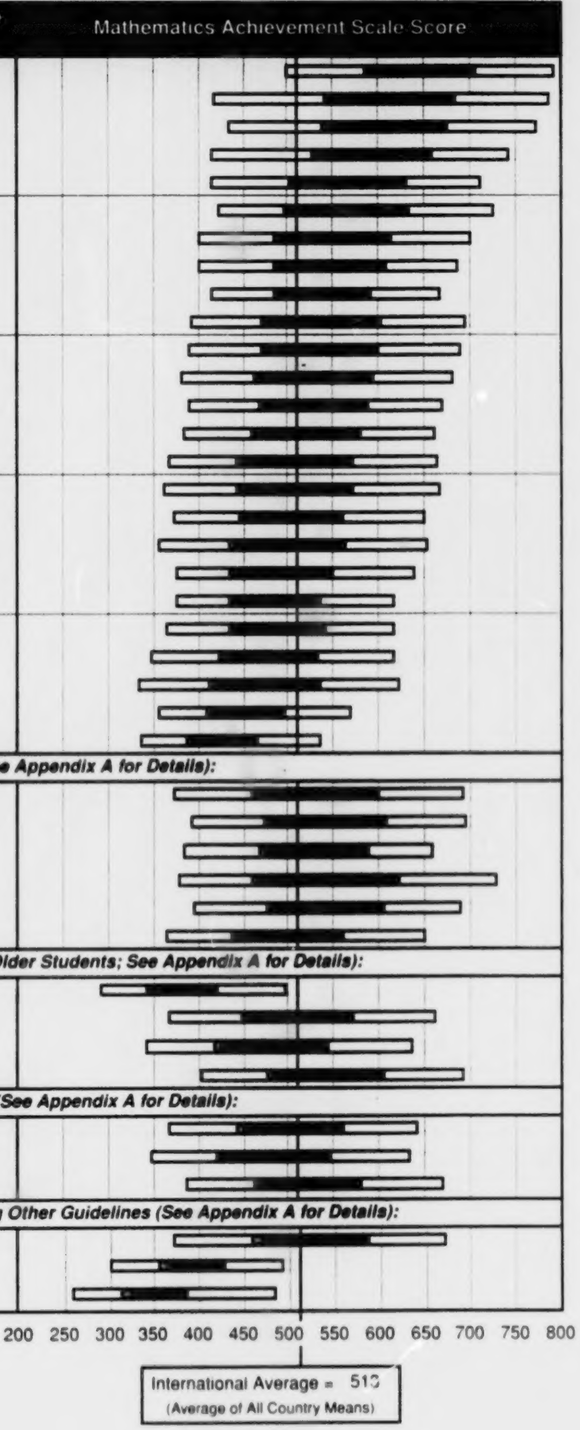
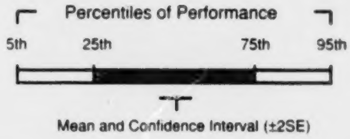
Table 1.1

Distributions of Mathematics Achievement - Upper Grade (Eighth Grade*)

Country	Mean	Years of Formal Schooling	Average Age
Singapore	643 (4.9)	8	14.5
Korea	607 (2.4)	8	14.2
Japan	605 (1.9)	8	14.4
Hong Kong	588 (6.5)	8	14.2
† Belgium (Fl)	565 (5.7)	8	14.1
Czech Republic	564 (4.9)	8	14.4
Slovak Republic	547 (3.3)	8	14.3
¹ Switzerland	545 (2.8)	7 or 8	14.2
France	538 (2.9)	8	14.3
Hungary	537 (3.2)	8	14.3
Russian Federation	535 (5.3)	7 or 8	14.0
Ireland	527 (5.1)	8	14.4
Canada	527 (2.4)	8	14.1
Sweden	519 (3.0)	7	13.9
New Zealand	508 (4.5)	8.5 - 9.5	14.0
†² England	506 (2.6)	9	14.0
Norway	503 (2.2)	7	13.9
† United States	500 (4.6)	8	14.2
¹ Latvia (LSS)	493 (3.1)	8	14.3
Spain	487 (2.0)	8	14.3
Iceland	487 (4.5)	8	13.6
¹ Lithuania	477 (3.5)	8	14.3
Cyprus	474 (1.9)	8	13.7
Portugal	454 (2.5)	8	14.5
Iran, Islamic Rep.	428 (2.2)	8	14.6
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):			
Australia	530 (4.0)	8 or 9	14.2
Austria	539 (3.0)	8	14.3
Belgium (Fr)	526 (3.4)	8	14.3
Bulgaria	540 (6.3)	8	14.0
Netherlands	541 (6.7)	8	14.3
Scotland	498 (5.5)	9	13.7
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):			
Colombia	385 (3.4)	8	15.7
†¹ Germany	509 (4.5)	8	14.8
Romania	482 (4.0)	8	14.6
Slovenia	541 (3.1)	8	14.8
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):			
Denmark	502 (2.8)	7	13.9
Greece	484 (3.1)	8	13.6
Thailand	522 (5.7)	8	14.3
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):			
¹ Israel	522 (6.2)	8	14.1
Kuwait	392 (2.5)	9	15.3
South Africa	354 (4.4)	8	15.4




Percentiles of Performance
5th
25th
75th
95th
Mean and Confidence Interval (±2SE)

---

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

¹National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

²National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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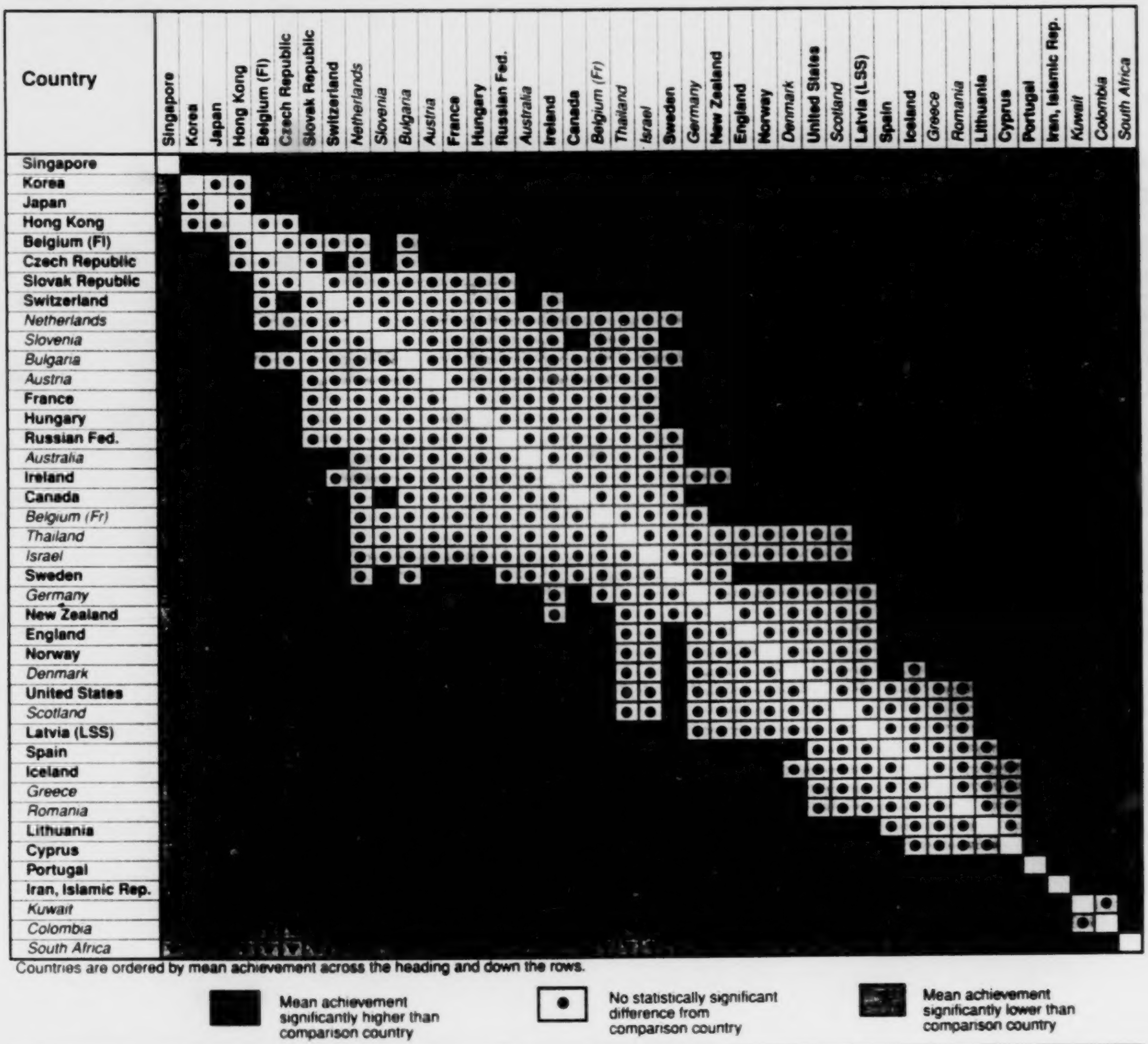
Figure 1.1

Multiple Comparisons of Mathematics Achievement - Upper Grade (Eighth Grade*)

Instructions: Read ***across*** the row for a country to compare performance with the countries listed in the heading of the chart. The symbols indicate whether the mean achievement of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the two countries. ¹



Countries are ordered by mean achievement across the heading and down the rows.

■ Mean achievement significantly higher than comparison country
● No statistically significant difference from comparison country
▨ Mean achievement significantly lower than comparison country

---

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

¹Statistically significant at .05 level, adjusted for multiple comparisons.

Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Appendix A for details).

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

The results reveal substantial differences in average mathematics achievement between the top- and bottom-performing countries, although most countries had achievement somewhere in the middle ranges. To illustrate the broad range of achievement both across and within countries, Table 1.1 also provides a visual representation of the distribution of student performance within each country. Achievement for each country is shown for the 25th and 75th percentiles as well as for the 5th and 95th percentiles.[3] Each percentile point indicates the percentages of students performing below and above that point on the scale. For example, 25% of the eighth-grade students in each country performed below the 25th percentile for that country, and 75% performed above the 25th percentile.

The range between the 25th and 75th percentiles represents performance by the middle half of the students. In contrast, performance at the 5th and 95th percentiles represents the extremes in both lower and higher achievement. The dark boxes at the midpoints of the distributions show the 95% confidence intervals around the average achievement in each country.[4] These intervals can be compared to the international average of 513, which was derived by averaging across the means for each of the 41 participants shown on the table.[5] A number of countries had mean achievement well above the international average of 513, and others had mean achievement well below that level.

Comparisons also can be made across the means and percentiles. For example, average performance in Singapore was comparable to or even exceeded performance at the 95th percentile in the lower-performing countries such as Portugal, Iran, Kuwait, Colombia, and South Africa. Also, the differences between the extremes in performance were very large within most countries.

Figure 1.1 provides a method for making appropriate comparisons in overall mean achievement between countries.[6] This figure shows whether or not the differences in mean achievement between pairs of countries are statistically significant. Selecting a country of interest and reading across the table, a triangle pointing up indicates significantly higher performance than the country listed across the top, a dot indicates no significant difference in performance, and a triangle pointing down indicates significantly lower performance.

At the eighth grade, Singapore, with all triangles pointing up, had significantly higher mean achievement than other participating countries. Korea, Japan, and Hong Kong also performed very well. Korea and Japan performed similarly to each other and better than all of the other participating countries except Singapore. Besides showing no significant difference from Korea and Japan, Hong Kong also performed about the same as Flemish-speaking Belgium and the Czech Republic. Interestingly, from the top-performing countries on down through the list of participants, the differences in performance from one country to the next were often negligible. For example, in addition to performing similarly to each other and Hong Kong, Belgium-Flemish and the Czech Republic also performed similarly to the Slovak Republic, the Netherlands, and Bulgaria. In turn, the Slovak Republic also performed similarly to Switzerland, Slovenia, Austria, France, Hungary, and the Russian Federation.

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[3] Tables of the percentile values and standard deviations for all countries are presented in Appendix E.

[4] See the "IRT Scaling and Data Analysis" section of Appendix A for more details about calculating standard errors and confidence intervals for the TIMSS statistics.

[5] Because the Flemish and French educational systems in Belgium participated separately, their results are presented separately in the tables in this report.

[6] The significance tests in Figures 1.1 and 1.2 are based on a Bonferroni procedure for multiple comparisons that holds to 5% the probability of erroneously declaring the mean of one country to be different from another country.

Despite the small differences from one country to the next, however, spanning across all the participating TIMSS countries, the performance differences from the top-performing to the bottom-performing countries was very large. Because of this large range in performance, the pattern for a number of countries was one of having lower mean achievement than some countries, about the same mean achievement as some countries, and higher mean achievement than other countries. In contrast, Kuwait and Colombia, which performed similarly to each other, had significantly lower means than all other countries except South Africa.

Table 1.2 and Figure 1.2 present corresponding data for the seventh grade.[7] The cluster of the four highest performing countries is the same as at the eighth grade. Seventh-grade students in Singapore had significantly higher mean achievement than other participating countries, with Korea, Japan, and Hong Kong also performing very well and similarly to each other. For the remaining countries, performance rankings tended to be similar, but not identical, to those found at the eighth grade. For example, at the seventh grade, Flemish-speaking Belgium had higher achievement than the Czech Republic. Flemish-speaking Belgium performed as well as Hong Kong but not as well as Korea and Japan. The Czech Republic, the Netherlands, Bulgaria, Austria, the Slovak Republic, and French-speaking Belgium all performed at about the same level.

It can be noted that the international average at the eighth grade (513) was nearly 30 points higher than the international average of 484 shown at the seventh grade. Even though equivalent achievement increases cannot be assumed from grade to grade throughout schooling, this 30-point difference does provide a rough indication of grade-by-grade increases in mathematics achievement during the middle school years. By this gauge, the achievement differences across countries at both grades reflect several grade levels in learning between the higher- and lower-performing countries. A similarly large range in performance can be noted within most countries. There needs to be a further note of caution, however, in using growth from grade to grade as an indicator of achievement. The TIMSS scale measures achievement in mathematics judged to be appropriate for seventh- and eighth-grade students around the world. Thus, higher performance does not mean students can do advanced secondary-school mathematics, only that they are more proficient at middle-school mathematics.

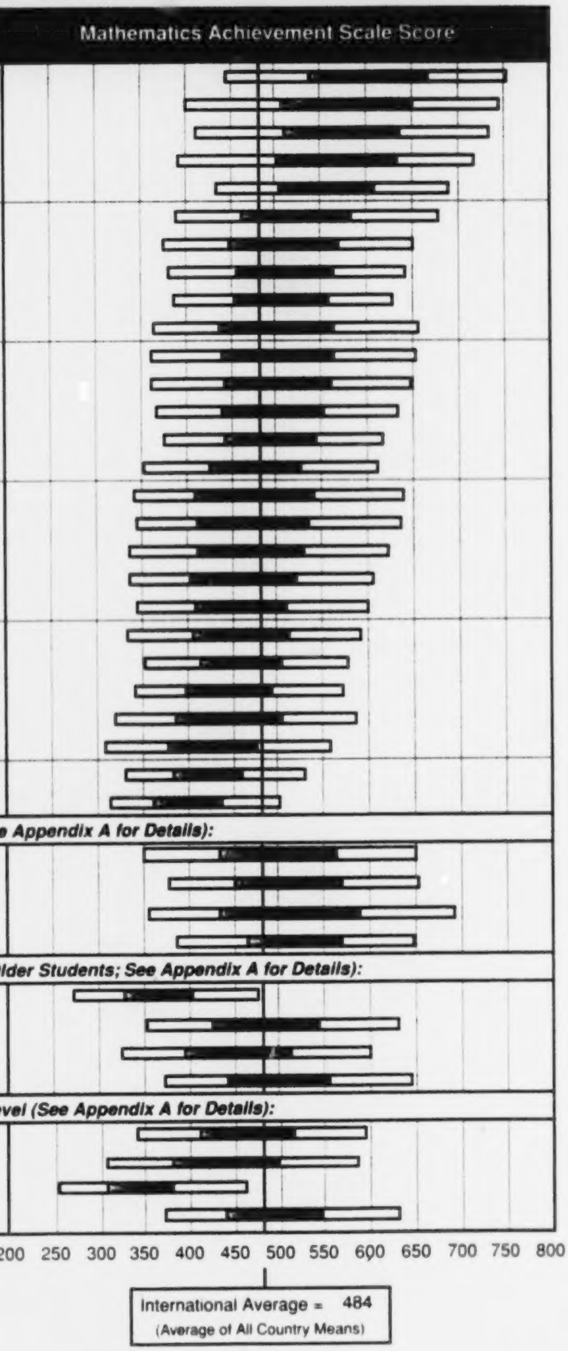
---

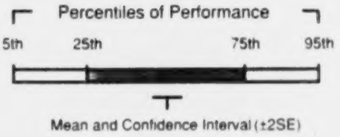
[7] Results are presented for 27 countries in the top portion of Table 1.2 because French-speaking Belgium and Scotland met the sampling requirements at this grade. Thirty-nine countries are presented in total because Kuwait and Israel tested only the eighth grade.

Table 1.2

Distributions of Mathematics Achievement - Lower Grade (Seventh Grade*)

Country	Mean	Years of Formal Schooling	Average Age
Singapore	601 (6.3)	7	13.3
Korea	577 (2.5)	7	13.2
Japan	571 (1.9)	7	13.4
Hong Kong	564 (7.8)	7	13.2
† Belgium (Fl)	558 (3.5)	7	13.0
Czech Republic	523 (4.9)	7	13.4
Slovak Republic	508 (3.4)	7	13.3
† Belgium (Fr)	507 (3.5)	7	13.2
¹ Switzerland	506 (2.3)	6 or 7	13.1
Hungary	502 (3.7)	7	13.4
Russian Federation	501 (4.0)	6 or 7	13.0
Ireland	500 (4.1)	7	13.4
Canada	494 (2.2)	7	13.1
France	492 (3.1)	7	13.3
Sweden	477 (2.5)	6	12.9
†² England	476 (3.7)	8	13.1
† United States	476 (5.5)	7	13.2
New Zealand	472 (3.8)	7.5 - 8.5	13.0
† Scotland	463 (3.7)	8	12.7
¹ Latvia (LSS)	462 (2.8)	7	13.3
Norway	461 (2.8)	6	12.9
Iceland	459 (2.6)	7	12.6
Spain	448 (2.2)	7	13.2
Cyprus	446 (1.9)	7	12.8
¹ Lithuania	428 (3.2)	7	13.4
Portugal	423 (2.2)	7	13.4
Iran, Islamic Rep.	401 (2.0)	7	13.6
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):			
Australia	498 (3.8)	7 or 8	13.2
Austria	509 (3.0)	7	13.3
Bulgaria	514 (7.5)	7	13.1
Netherlands	516 (4.1)	7	13.2
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):			
Colombia	369 (2.7)	7	14.5
†¹ Germany	484 (4.1)	7	13.8
Romania	454 (3.4)	7	13.7
Slovenia	498 (3.0)	7	13.8
Countries With Unapproved Sampling Procedures At The Classroom Level (See Appendix A for Details):			
Denmark	465 (2.1)	6	12.9
Greece	440 (2.8)	7	12.6
† South Africa	348 (3.8)	7	13.9
Thailand	495 (4.8)	7	13.5




Percentiles of Performance
5th
25th
75th
95th
Mean and Confidence Interval (±2SE)

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*Seventh grade in most countries; see Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

¹National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

²National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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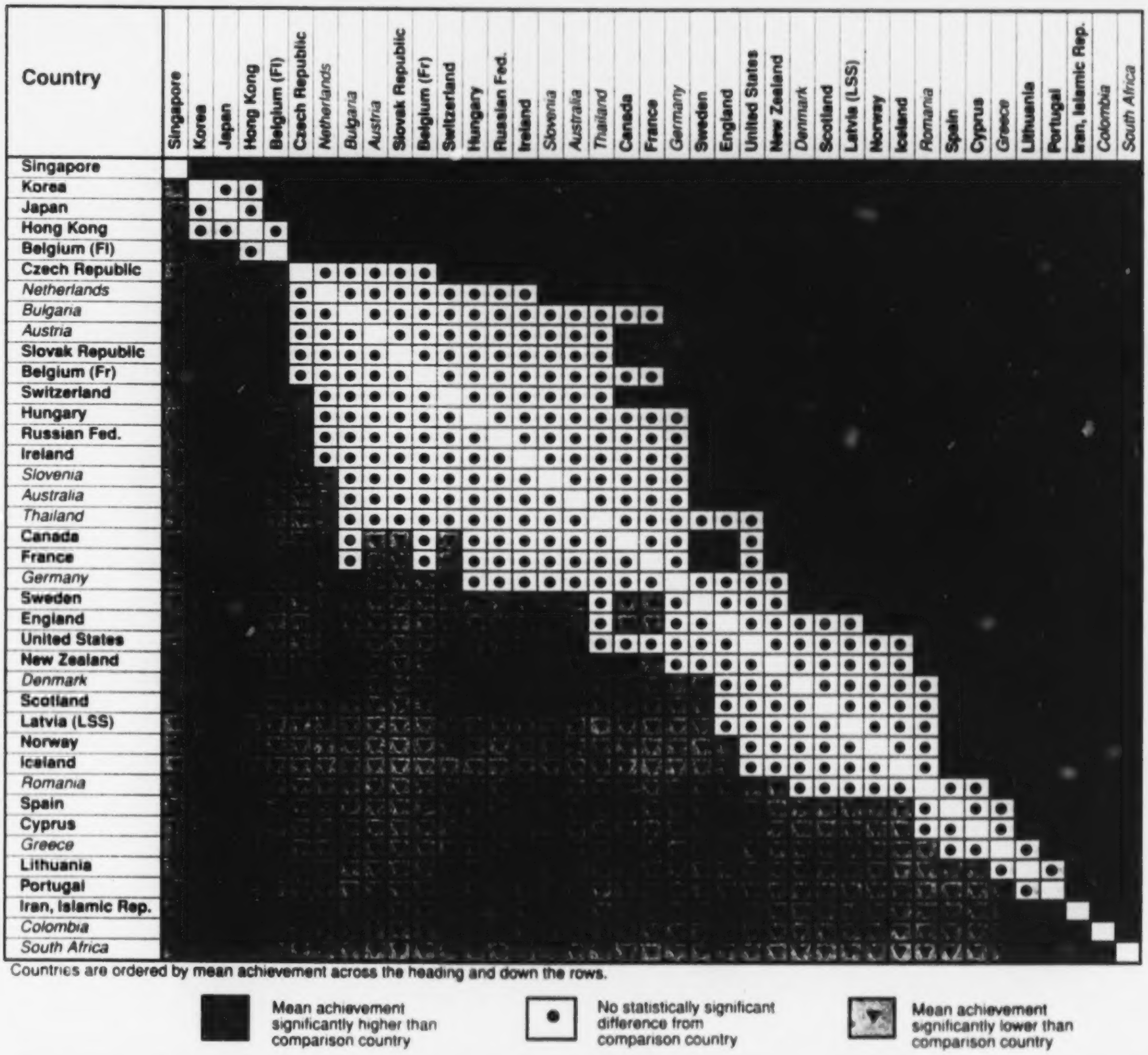
Figure 1.2

Multiple Comparisons of Mathematics Achievement - Lower Grade (Seventh Grade*)

Instructions: Read **across** the row for a country to compare performance with the countries listed in the heading of the chart. The symbols indicate whether the mean achievement of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the two countries.[1]



Countries are ordered by mean achievement across the heading and down the rows.

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*Seventh grade in most countries; see Table 2 for information about the grades tested in each country.

[1] Statistically significant at .05 level, adjusted for multiple comparisons.

Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Appendix A for details).

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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WHAT ARE THE INCREASES IN ACHIEVEMENT BETWEEN THE LOWER AND UPPER GRADES?

Table 1.3 shows the increases in mean achievement between the two grades tested in each TIMSS country. Countries in the upper portion of the table are shown in decreasing order by the amount of this difference. Increases in mean performance between the two grades ranged from a high of 49 points in Lithuania to a low of 8 points in the Flemish-speaking part of Belgium[8] and 7 points in South Africa.[9] This degree of increase can be compared to the difference of nearly 30 points between the international average of 513 at eighth grade and that of 484 at seventh grade. Despite the larger increases in some countries compared to others, there is no obvious relationship between mean seventh-grade performance and the difference between that and mean eighth-grade performance. That is, countries showing the highest performance at the seventh grade did not necessarily show either the largest or smallest increases in achievement at the eighth grade. Still, in general, countries with high mean performance in the seventh grade also had high mean performance in the eighth grade.

---

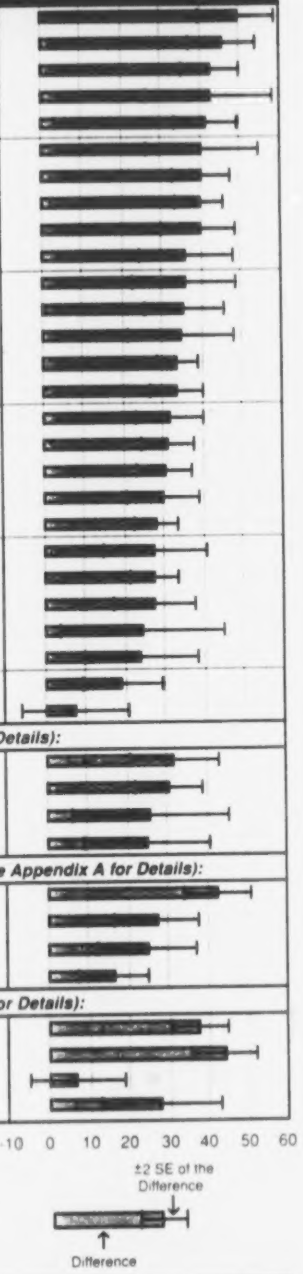
[8] Both the Flemish and French educational systems in Belgium have policies whereby lower-performing sixth-grade students continue their study of the primary school curriculum and then re-enter the system as part of a vocational track in the eighth grade. Since these lower-performing students are not included in the seventh-grade results, but do compose about 10% of the sample at the eighth grade, this contributed to reduced performance differences between the seventh and eighth grades.

[9] In South Africa, there is no structural reason to explain the relatively small difference between seventh- and eighth-grade performance. However, in 1995, its education system was undergoing radical reorganization from 18 racially-divided systems into 9 provincial systems.

Table 1.3

Achievement Differences in Mathematics Between Lower and Upper Grades (Seventh and Eighth Grades*)

Country	Seventh Grade Mean	Eighth Grade Mean	Eighth-Seventh Difference
[1] Lithuania	428 (3.2)	477 (3.5)	49 (4.7)
France	492 (3.1)	538 (2.9)	46 (4.3)
Norway	461 (2.8)	503 (2.2)	43 (3.6)
Singapore	601 (6.3)	643 (4.9)	42 (8.0)
Sweden	477 (2.5)	519 (3.0)	41 (3.9)
Czech Republic	523 (4.9)	564 (4.9)	40 (7.0)
† Switzerland	506 (2.3)	545 (2.8)	40 (3.6)
Spain	448 (2.2)	487 (2.0)	39 (3.0)
Slovak Republic	508 (3.4)	547 (3.3)	39 (4.7)
New Zealand	472 (3.8)	508 (4.5)	36 (5.9)
† Scotland	463 (3.7)	498 (5.5)	36 (6.6)
Hungary	502 (3.7)	537 (3.2)	35 (4.9)
Russian Federation	501 (4.0)	535 (5.3)	35 (6.6)
Japan	571 (1.9)	605 (1.9)	34 (2.7)
Canada	494 (2.2)	527 (2.4)	33 (3.3)
[1] Latvia (LSS)	462 (2.8)	493 (3.1)	32 (4.2)
Portugal	423 (2.2)	454 (2.5)	31 (3.3)
Korea	577 (2.5)	607 (2.4)	30 (3.5)
†[2] England	476 (3.7)	506 (2.6)	30 (4.5)
Cyprus	446 (1.9)	474 (1.9)	28 (2.7)
Ireland	500 (4.1)	527 (5.1)	28 (6.6)
Iran, Islamic Rep.	401 (2.0)	428 (2.2)	27 (2.9)
Iceland	459 (2.6)	487 (4.5)	27 (5.2)
Hong Kong	564 (7.8)	588 (6.5)	24 (10.2)
† United States	476 (5.5)	500 (4.6)	24 (7.2)
† Belgium (Fr)	507 (3.5)	526 (3.4)	19 (4.9)
† Belgium (Fl)	558 (3.5)	565 (5.7)	8 (6.7)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):			
Australia	498 (3.8)	530 (4.0)	32 (5.5)
Austria	509 (3.0)	539 (3.0)	30 (4.3)
Bulgaria	514 (7.5)	540 (6.3)	26 (9.8)
Netherlands	516 (4.1)	541 (6.7)	25 (7.8)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students: See Appendix A for Details):			
Slovenia	498 (3.0)	541 (3.1)	43 (4.3)
Romania	454 (3.4)	482 (4.0)	27 (5.3)
†[1] Germany	484 (4.1)	509 (4.5)	25 (6.1)
Colombia	369 (2.7)	385 (3.4)	16 (4.4)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):			
Denmark	465 (2.1)	502 (2.8)	37 (3.5)
Greece	440 (2.8)	484 (3.1)	44 (4.2)
South Africa	348 (3.8)	354 (4.4)	7 (5.9)
Thailand	495 (4.8)	522 (5.7)	28 (7.5)



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*Seventh and eighth grades in most countries; see Table 2 for infomation about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some differences may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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WHAT ARE THE DIFFERENCES IN PERFORMANCE COMPARED TO THREE MARKER LEVELS OF INTERNATIONAL MATHEMATICS ACHIEVEMENT?

Tables 1.4 and 1.5 portray performance in terms of international levels of achievement for the eighth and seventh grades, respectively. Since the TIMSS achievement tests do not have any pre-specified performance standards, three marker levels were chosen on the basis of the combined performance of all students at a grade level in the study — the Top 10%, the Top Quarter (25%), and the Top Half (50%). For example, Table 1.4 shows that 10% of all eighth graders in countries participating in the TIMSS study achieved at the level of 656 or better. This score point, then, was designated as the marker level for the Top 10%. Similarly, the Top Quarter marker level was determined as 587 and the Top Half marker level as 509. At the seventh grade, the three marker levels are: Top 10% – 619, Top Quarter – 551, and Top Half – 476.

If every country had the same distribution of high-, medium-, and low-performing students, then each country would be expected to have approximately 10% of its students reaching the Top 10% level, 25% reaching the Top Quarter level, and 50% reaching the Top Half level. Although no country achieved exactly this pattern at either grade tested, the data in Tables 1.4 and 1.5 indicate that in both grades Ireland came close to the international norm from the perspective of relative percentages of high-performing students. In contrast, at both grades close to half the students in Singapore (45% at the eighth grade and 44% at the seventh grade) reached the Top 10% level, about three-fourths (74% and 70%) reached the Top Quarter level, and more than 90% performed at or above the Top Half level (94% and 91%).

It can be informative to look at performance at each marker level. For example, the results in Table 1.4 show that students in New Zealand did not quite attain the Top 10% or Top Quarter levels for the eighth grade, with 6% and 20% of the students reaching those levels, respectively. However, performance approximated the marker level for the Top Half (48%). Achievement in England was nearly identical to that of New Zealand in this regard. In France, achievement fell somewhat short at the Top 10% level (7%), approximated the Top Quarter level (26%), and exceeded the Top Half level (63%).

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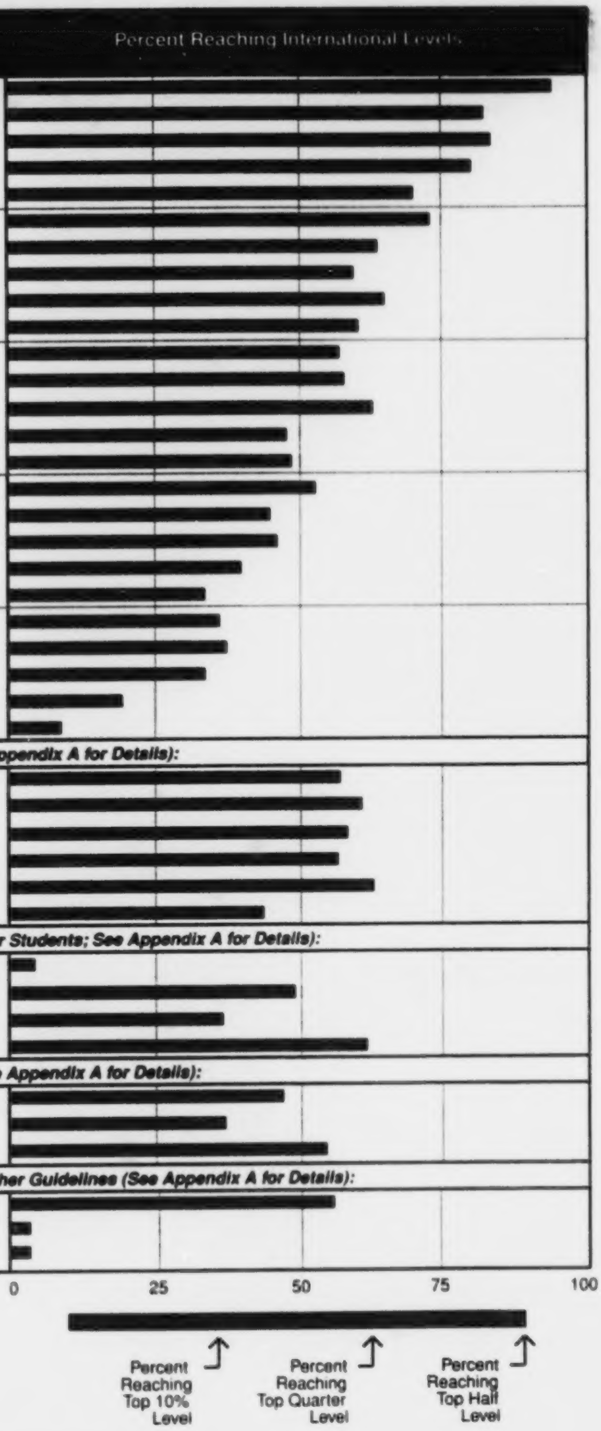
Table 1.4

Percentages of Students Achieving International Marker Levels in Mathematics Upper Grade (Eighth Grade*)

Country	Top 10% Level	Top Quarter Level	Top Half Level
Singapore	45 (2.5)	74 (2.1)	94 (0.8)
Korea	34 (1.1)	58 (1.0)	82 (0.8)
Japan	32 (0.8)	58 (0.9)	83 (0.6)
Hong Kong	27 (2.1)	53 (2.6)	80 (2.4)
Czech Republic	18 (1.9)	39 (2.3)	70 (1.9)
† Belgium (Fl)	17 (1.2)	41 (2.3)	73 (2.9)
Slovak Republic	12 (1.0)	33 (1.5)	64 (1.6)
Hungary	11 (0.8)	29 (1.3)	60 (1.6)
[1] Switzerland	11 (0.7)	33 (1.2)	65 (1.4)
Russian Federation	10 (0.7)	29 (2.4)	60 (2.6)
Ireland	9 (1.0)	27 (1.9)	57 (2.4)
Canada	7 (0.7)	25 (1.1)	58 (1.2)
France	7 (0.8)	26 (1.5)	63 (1.5)
†[2] England	7 (0.6)	20 (1.1)	48 (1.4)
New Zealand	6 (0.8)	20 (1.6)	48 (2.2)
Sweden	5 (0.5)	22 (1.2)	53 (1.5)
† United States	5 (0.6)	18 (1.5)	45 (2.3)
Norway	4 (0.4)	17 (0.9)	46 (1.2)
[1] Latvia (LSS)	3 (0.5)	14 (1.2)	40 (1.5)
Cyprus	2 (0.3)	11 (0.6)	34 (1.1)
Spain	2 (0.2)	10 (0.7)	36 (1.2)
Iceland	1 (0.3)	10 (1.3)	37 (2.9)
[1] Lithuania	1 (0.3)	10 (1.0)	34 (1.8)
Portugal	0 (0.1)	2 (0.4)	19 (1.3)
Iran, Islamic Rep.	0 (0.0)	0 (0.2)	9 (0.8)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):			
Australia	11 (0.9)	29 (1.5)	57 (1.7)
Austria	11 (0.7)	31 (1.3)	61 (1.4)
Belgium (Fr)	6 (0.6)	25 (1.5)	58 (1.7)
Bulgaria	16 (1.9)	33 (2.7)	57 (2.7)
Netherlands	10 (1.6)	30 (2.7)	63 (3.2)
Scotland	5 (0.9)	17 (2.1)	44 (2.7)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):			
Colombia	0 (0.0)	1 (0.3)	4 (0.8)
†[1] Germany	6 (0.7)	20 (1.7)	49 (2.3)
Romania	3 (0.4)	13 (1.1)	36 (2.0)
Slovenia	11 (0.7)	31 (1.4)	61 (1.5)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):			
Denmark	4 (0.5)	17 (1.0)	47 (1.6)
Greece	3 (0.4)	13 (0.8)	37 (1.5)
Thailand	7 (1.2)	23 (2.6)	54 (2.7)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):			
[1] Israel	6 (0.9)	24 (2.5)	56 (2.6)
Kuwait	0 (0.0)	0 (0.1)	3 (0.5)
South Africa	0 (0.0)	0 (0.0)	2 (0.9)



The international levels correspond to the percentiles computed from the combined data from all of the participating countries.

Top 10% Level (90th Percentile) = 656
Top Quarter Level (75th Percentile) = 587
Top Half Level (50th Percentile) = 509

---

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some differences may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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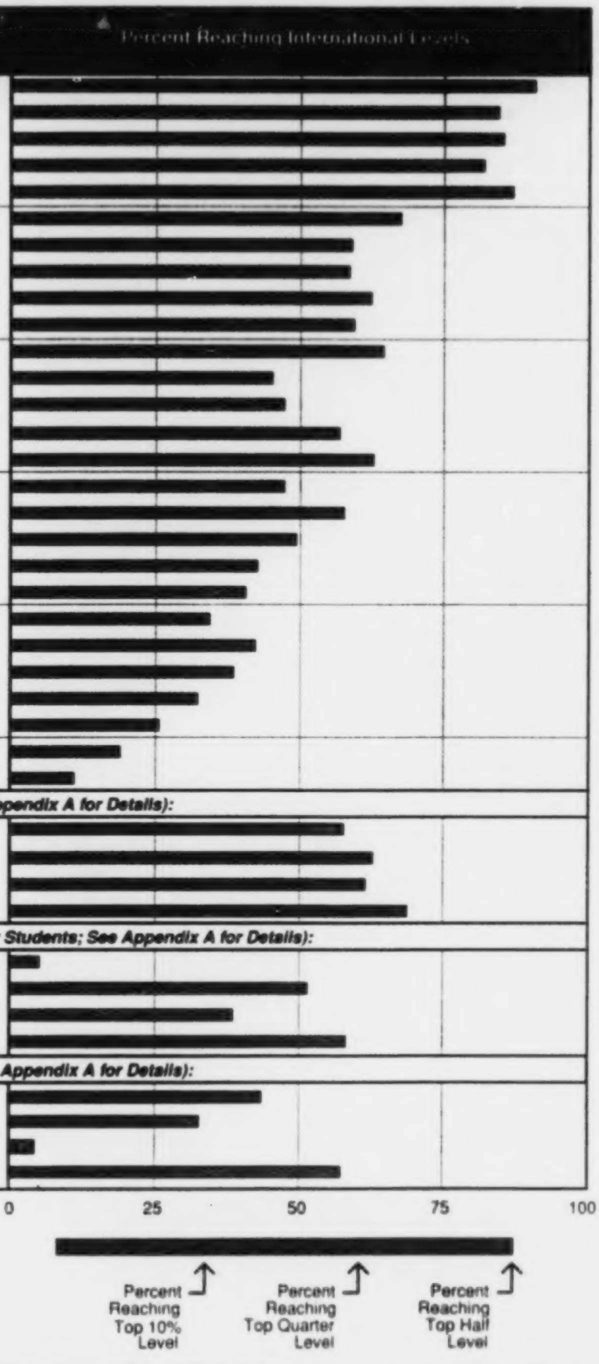
Table 1.5

Percentages of Students Achieving International Marker Levels in Mathematics Lower Grade (Seventh Grade*)

Country	Top 10% Level	Top Quarter Level	Top Half Level
Singapore	44 (3.0)	70 (2.7)	91 (1.4)
Korea	34 (1.1)	61 (1.1)	84 (0.7)
Japan	31 (1.0)	58 (0.9)	85 (0.6)
Hong Kong	30 (2.5)	56 (3.3)	81 (2.8)
[†] Belgium (Fl)	22 (1.8)	52 (2.0)	86 (1.2)
Czech Republic	15 (1.8)	34 (2.4)	67 (1.9)
Hungary	11 (1.1)	29 (1.5)	59 (1.8)
Russian Federation	11 (1.1)	28 (1.6)	59 (1.8)
Slovak Republic	10 (1.0)	31 (1.4)	62 (1.7)
Ireland	9 (0.9)	27 (1.7)	60 (2.2)
[†] Belgium (Fr)	7 (0.9)	28 (1.5)	64 (2.0)
[†] United States	7 (1.2)	21 (2.3)	45 (2.7)
[†2] England	7 (0.9)	21 (1.4)	47 (1.7)
Canada	7 (0.5)	25 (1.0)	57 (1.4)
[1] Switzerland	6 (0.5)	28 (0.9)	63 (1.3)
New Zealand	5 (0.6)	19 (1.4)	47 (2.0)
France	4 (0.4)	21 (1.3)	58 (1.9)
Sweden	4 (0.4)	17 (0.9)	50 (1.5)
[†] Scotland	4 (0.5)	15 (1.4)	43 (2.1)
[1] Latvia (LSS)	3 (0.4)	12 (0.9)	41 (1.6)
Cyprus	2 (0.3)	11 (0.6)	35 (1.1)
Norway	2 (0.3)	11 (1.0)	42 (1.4)
Iceland	1 (0.3)	8 (0.9)	38 (1.9)
Spain	1 (0.2)	8 (0.7)	32 (1.2)
[†] Lithuania	1 (0.2)	6 (0.7)	26 (1.6)
Portugal	0 (0.1)	3 (0.4)	19 (1.3)
Iran, Islamic Rep.	0 (0.0)	1 (0.2)	11 (0.9)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):			
Australia	10 (1.0)	28 (1.6)	58 (1.7)
Austria	10 (0.7)	31 (1.4)	63 (1.6)
Bulgaria	16 (2.2)	35 (3.1)	62 (2.8)
Netherlands	9 (1.3)	33 (2.4)	69 (2.2)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):			
Colombia	0 (0.0)	1 (0.2)	5 (0.9)
[†1] Germany	6 (0.8)	22 (1.8)	52 (2.0)
Romania	3 (0.4)	14 (1.0)	39 (1.7)
Slovenia	8 (0.7)	25 (1.4)	58 (1.6)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):			
Denmark	3 (0.4)	14 (0.9)	44 (1.5)
Greece	2 (0.3)	11 (0.9)	32 (1.3)
[†] South Africa	0 (0.0)	1 (0.6)	4 (1.1)
Thailand	7 (1.2)	23 (2.3)	57 (2.5)



The international levels correspond to the percentiles computed from the combined data from all of the participating countries.

Top 10% Level (90th Percentile) = 619
Top Quarter Level (75th Percentile) = 551
Top Half Level (50th Percentile) = 476

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*Seventh grade in most countries; see Table 2 for information about the grades tested in each country.

[†] Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some differences may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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WHAT ARE THE GENDER DIFFERENCES IN MATHEMATICS ACHIEVEMENT?

Tables 1.6 and 1.7, showing the differences in achievement by gender, reveal that, in most countries, girls and boys had approximately the same average mathematics achievement as each other at both grades. However, the differences in achievement that did exist in some countries tended to favor boys rather than girls.

Each of the two tables, the first one for the eighth grade and the second for the seventh grade, presents mean mathematics achievement separately for boys and girls for each country, as well as the difference between the means. The visual representation of the gender difference for each country, shown by a bar, indicates the amount of the difference, whether the direction of the difference favors girls or boys, and whether or not the difference is statistically significant (indicated by a darkened bar). Regardless of their directions, about three-fourths of the differences were not statistically significant, indicating that, for most countries, gender differences in mathematics achievement generally are small or negligible in the middle years of schooling. That is, nearly three-quarters of the differences favoring boys at the eighth grade and more than three-quarters at the seventh grade were not statistically significant. Also, girls had higher mean achievement than boys in nine countries (across both grades), even though those results were not statistically significant either.

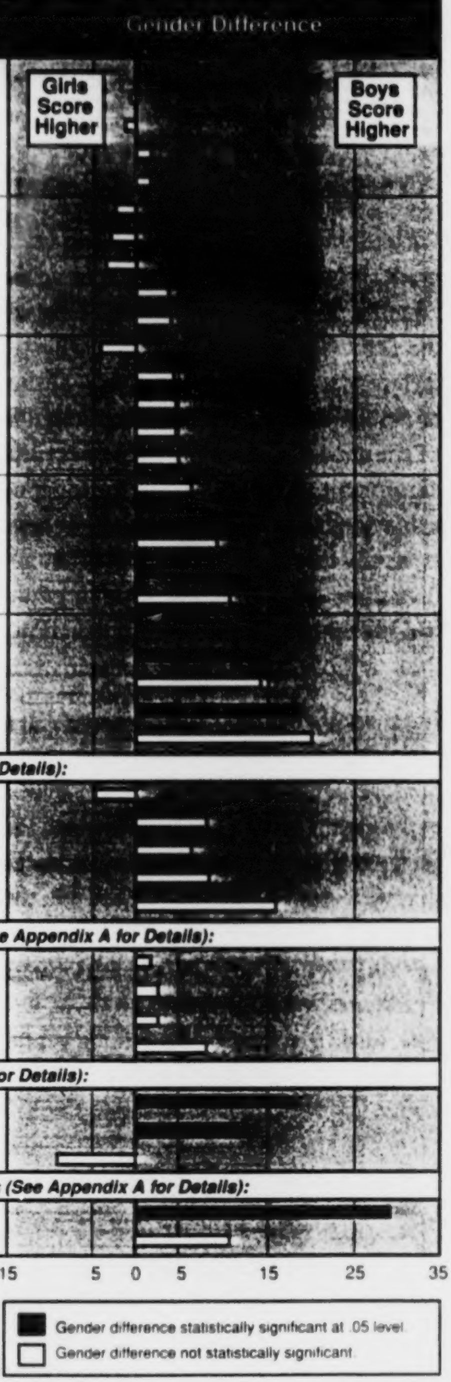
From another perspective, however, all the statistically significant differences favored boys rather than girls. At both grades, boys had significantly higher mathematics achievement than girls in Japan, Iran, and Korea. Further, boys outperformed girls at the eighth grade in Spain, Portugal, Denmark, Greece, and Israel, and at the seventh grade in Belgium (French), Switzerland, and England. Also, including those differences that were not statistically significant, the direction at both grades favored boys much more often than girls. A sign test across countries indicates that internationally there is a significant difference in achievement by gender favoring males. The gender differences in mathematics, however, were much less pronounced than those in science. The TIMSS science results for seventh and eighth grades show significant gender differences favoring males to be pervasive across most countries.[10]

Beaton, A.E., Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Smith, T.A., and Kelly, D.L. (1996). *Science Achievement in the Middle School Years: The IEA's Third International Mathematics and Science Study (TIMSS).* Chestnut Hill, MA: Boston College.

Table 1.6

Gender Differences in Mathematics Achievement - Upper Grade (Eighth Grade*)

Country	Boys Mean	Girls Mean	Difference Absolute Value
Hungary	537 (3.6)	537 (3.6)	0 (5.1)
Lithuania[1]	477 (4.0)	478 (4.1)	1 (5.7)
Russian Federation	535 (6.3)	536 (5.0)	1 (8.0)
Iceland	488 (5.5)	486 (5.6)	2 (7.8)
Sweden	520 (3.6)	518 (3.1)	2 (4.7)
Singapore	642 (6.3)	645 (5.4)	2 (8.3)
Cyprus	472 (2.8)	475 (2.5)	3 (3.7)
Canada	526 (3.2)	530 (2.7)	4 (4.2)
Slovak Republic	549 (3.7)	545 (3.6)	4 (5.2)
Norway	505 (2.8)	501 (2.7)	4 (3.9)
Belgium (Fl)†	563 (8.8)	567 (7.4)	4 (11.5)
England†[2]	508 (5.1)	504 (3.5)	4 (6.2)
Latvia (LSS)[1]	496 (3.8)	491 (3.5)	4 (5.2)
United States†	502 (5.2)	497 (4.5)	5 (6.9)
Switzerland[1]	548 (3.5)	543 (3.1)	5 (4.7)
France	542 (3.1)	536 (3.8)	6 (4.9)
Japan	609 (2.6)	600 (2.1)	9 (3.3)
New Zealand	512 (5.9)	503 (5.3)	9 (7.9)
Spain	492 (2.5)	483 (2.6)	10 (3.6)
Czech Republic	569 (4.5)	558 (6.3)	11 (7.7)
Portugal	460 (2.8)	449 (2.7)	11 (3.9)
Iran, Islamic Rep.	434 (2.9)	421 (3.3)	13 (4.4)
Ireland	535 (7.2)	520 (6.0)	14 (9.3)
Korea	615 (3.2)	598 (3.4)	17 (4.7)
Hong Kong	597 (7.7)	577 (7.7)	20 (10.9)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):			
Australia	527 (5.1)	532 (4.6)	5 (6.9)
Austria	544 (3.2)	536 (4.5)	8 (5.6)
Belgium (Fr)	530 (4.7)	524 (3.7)	6 (6.0)
Netherlands	545 (7.8)	536 (6.4)	8 (10.1)
Scotland	506 (6.6)	490 (5.2)	16 (8.4)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):			
Colombia	386 (6.9)	384 (3.6)	2 (7.7)
Germany†[1]	512 (5.1)	509 (5.0)	3 (7.1)
Romania	483 (4.8)	480 (4.0)	3 (6.2)
Slovenia	545 (3.8)	537 (3.3)	8 (5.0)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):			
Denmark	511 (3.2)	494 (3.4)	17 (4.7)
Greece	490 (3.7)	478 (3.1)	12 (4.8)
Thailand	517 (5.6)	526 (7.0)	9 (9.0)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):			
Israel[1]	539 (6.6)	509 (6.9)	29 (9.6)
South Africa	360 (6.3)	349 (4.1)	11 (7.5)



International Averages		
Boys	Girls	Difference
519	512	8

(Averages of all country means)

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*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

† Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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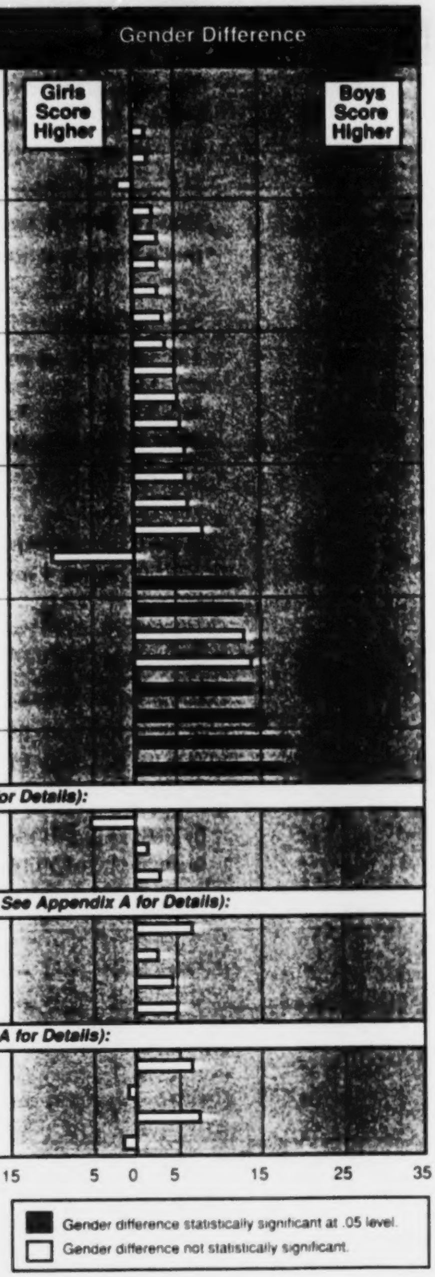
Table 1.7

Gender Differences in Mathematics Achievement - Lower Grade (Seventh Grade*)

Country	Boys' Mean	Girls' Mean	Difference Absolute Value
Cyprus	446 (2.5)	446 (2.6)	0 (3.6)
Singapore	601 (7.1)	601 (8.0)	0 (10.7)
Hungary	503 (3.8)	501 (4.4)	1 (5.8)
Canada	495 (2.7)	493 (2.6)	2 (3.8)
† Belgium (Fl)	557 (4.5)	559 (4.7)	2 (6.5)
Iceland	460 (2.7)	458 (3.2)	2 (4.2)
† Scotland	465 (4.6)	462 (3.8)	3 (5.9)
New Zealand	473 (4.6)	470 (3.8)	3 (5.9)
Russian Federation	502 (5.1)	499 (3.5)	3 (6.1)
Norway	462 (3.3)	459 (3.2)	4 (4.6)
[1] Latvia (LSS)	463 (3.5)	460 (3.3)	4 (4.8)
† United States	478 (5.7)	473 (5.7)	5 (8.1)
Sweden	480 (2.8)	475 (3.2)	5 (4.2)
Spain	451 (2.7)	445 (2.7)	5 (3.8)
Slovak Republic	511 (4.4)	505 (3.3)	6 (5.5)
Portugal	426 (2.7)	420 (2.2)	6 (3.5)
Czech Republic	527 (4.8)	520 (5.6)	6 (7.4)
France	497 (3.6)	489 (3.3)	8 (4.9)
[1] Lithuania	423 (3.6)	433 (3.5)	10 (5.0)
Japan	576 (2.7)	565 (2.0)	11 (3.4)
† Belgium (Fr)	514 (4.1)	501 (4.2)	13 (5.9)
Ireland	507 (6.0)	494 (4.8)	13 (7.7)
Hong Kong	570 (9.7)	556 (8.3)	14 (12.8)
Iran, Islamic Rep.	407 (2.7)	393 (2.3)	14 (3.5)
[1] Switzerland	513 (2.9)	498 (2.6)	14 (3.9)
†[2] England	484 (6.2)	467 (4.3)	17 (7.5)
Korea	584 (3.7)	567 (4.4)	17 (5.7)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):			
Australia	495 (5.2)	500 (4.3)	5 (6.8)
Austria	510 (4.6)	509 (3.3)	1 (5.6)
Netherlands	517 (5.2)	515 (4.3)	3 (6.7)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):			
Colombia	372 (3.8)	365 (3.9)	7 (5.4)
†[1] Germany	486 (4.8)	484 (4.5)	2 (6.6)
Romania	457 (3.7)	452 (3.7)	4 (5.2)
Slovenia	501 (3.5)	496 (3.2)	5 (4.7)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):			
Denmark	468 (2.8)	462 (2.9)	7 (4.0)
Greece	440 (3.2)	440 (3.0)	1 (4.4)
South Africa	352 (5.3)	344 (3.3)	8 (6.2)
Thailand	494 (4.8)	495 (5.7)	1 (7.5)



International Averages		
Boys	Girls	Difference
486	481	6

(Averages of all country means)

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*Seventh grade in most countries; see Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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WHAT ARE THE DIFFERENCES IN MEDIAN PERFORMANCE AT AGE 13?

For countries where the grades tested contained at least 75% of the 13-year-olds, TIMSS estimated the median performance for this age group. Table 1.8 provides this estimate as well as presenting estimates of the distribution of 13-year-olds across grades.[11] For many countries, the two grades tested included practically all of their 13-year-olds (nine countries have at least 98%), whereas, for some others, there were substantial percentages outside these grades, mostly in the grade below.[12] For countries included in Table 1.8, Hong Kong, Belgium (French), Hungary, France, Ireland, Latvia (LSS), Spain, Lithuania, Portugal, Austria, Romania, and Thailand had 10% or more of their 13-year-olds below the two grades tested.

The median is the point on the mathematics scale that divides the higher-performing 50% of the students from the lower-performing 50%. Like the mean, the median provides a useful summary statistic on which to compare performance across countries. It is used instead of the mean in this table because it can be reliably estimated even when scores from some members of the population are not available[13] (that is, those 13-year-olds outside the tested grades).

Notwithstanding the additional difficulties in calculating the age-based achievement estimates, the results for 13-year-olds appear quite consistent with those obtained for the two grade levels. The relative performance of countries in mathematics achievement on the basis of median performance of 13-year-olds is quite similar to that based on average eighth-grade and/or seventh-grade performance. Despite some slight differences in relative standings (generally within sampling error), the higher-performing countries in the eighth and seventh grades generally were those with higher-performing 13-year-olds.

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[11] For information about the distribution of 13-year-olds in all countries, not just those with 75% coverage, see Table A.3 in Appendix A.

[12] The number of 13-year-olds below the lower grade and above the upper grade tested were extrapolated from the estimated distribution of 13-year-olds in the tested grades.

[13] Because TIMSS sampled students in the two adjacent grades with the most 13-year-olds within a country, it was possible to estimate the median for the 13-year-old students when the two tested grades included at least an estimated 75% of the 13-year-olds in that country. To compute the median, TIMSS assumed that those 13-year-old students in the grades below the tested grades would score below the median and those in the grades above the tested grades would score above the median. The percentages assumed to be above and below the median were added to the tails of the distribution before calculating the median using the modified distribution.

Table 1.8

Median Mathematics Achievement - 13-Year-Old Students
Includes Only Countries Where the Grades Tested Contained at Least 75% of the 13-Year-Olds

Country	Median	Lower Grade	Upper Grade	Estimated Distribution of 13-Year-Olds			
					Percentage of 13-Year-Old Students Tested		
					Percent in Lower Grade	Percent in Upper Grade	
Singapore	608 (7.1)	Secondary 1	Secondary 2	3.1%	82.2%	14.7%	0.0%
Korea	591 (2.2)	1st Grade Middle School	2nd Grade Middle School	1.5%	69.9%	28.2%	0.4%
Japan	572 (3.7)	1st Grade Lower Secondary	2nd Grade Lower Secondary	0.3%	90.9%	8.8%	0.0%
Hong Kong	570 (7.8)	Secondary 1	Secondary 2	10.0%	44.2%	45.6%	0.2%
† Belgium (Fl)	562 (4.6)	1A	2A & 2P	5.4%	45.6%	48.8%	0.2%
[1] Switzerland	519 (2.4)	6 or 7	7 or 8	8.3%	47.6%	43.9%	0.2%
† Belgium (Fr)	516 (3.6)	1A	2A & 2P	13.3%	40.6%	46.0%	0.2%
Czech Republic	514 (5.2)	7	8	9.6%	73.3%	17.1%	0.0%
Russian Federation	511 (4.2)	7	8	4.5%	50.4%	44.3%	0.7%
Slovak Republic	511 (3.9)	7	8	4.7%	73.2%	22.1%	0.0%
Hungary	504 (3.7)	7	8	10.5%	65.1%	24.2%	20.0%
Canada	498 (5.9)	7	8	8.1%	48.4%	42.9%	0.6%
France	498 (3.0)	5eme	4eme (90%) or 4eme Technologique (10%)	20.5%	43.5%	34.7%	1.3%
Sweden	497 (2.4)	6	7	0.8%	44.9%	54.1%	0.1%
Ireland	492 (4.2)	1st Year	2nd Year	14.1%	69.0%	16.8%	0.2%
† Scotland	486 (5.7)	Secondary 1	Secondary 2	0.3%	24.0%	75.3%	0.5%
Norway	483 (2.8)	6	7	0.3%	42.5%	57.0%	0.2%
New Zealand	483 (7.2)	Form 2	Form 3	0.5%	51.7%	47.4%	0.4%
†[2] England	482 (4.4)	Year 8	Year 9	0.6%	57.2%	41.7%	0.5%
Iceland	479 (4.5)	7	8	0.2%	16.5%	83.0%	0.4%
† United States	472 (5.4)	7	8	9.0%	57.8%	33.1%	0.2%
Cyprus	460 (2.5)	7	8	1.7%	27.7%	69.9%	0.7%
[1] Latvia (LSS)	455 (3.2)	7	8	14.3%	59.5%	26.0%	0.2%
Spain	452 (3.3)	7 EGB	8 EGB	14.9%	45.8%	39.0%	0.3%
[1] Lithuania	429 (3.4)	7	8	10.1%	64.1%	25.6%	0.2%
Portugal	416 (1.8)	Grade 7	Grade 8	23.5%	44.1%	32.1%	0.3%
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix for Details):							
Australia	499 (4.3)	7 or 8	8 or 9	7.5%	63.6%	28.4%	0.5%
Austria	509 (3.1)	3. Klasse	4. Klasse	10.7%	62.4%	26.9%	0.0%
Bulgaria	516 (6.9)	7	8	3.2%	58.1%	36.9%	1.8%
Netherlands	519 (5.3)	Secondary 1	Secondary 2	9.8%	58.7%	31.2%	0.4%
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix for Details):							
Romania	419 (3.9)	7	8	23.9%	66.6%	9.3%	0.3%
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix for Details):							
Denmark	485 (3.5)	6	7	1.0%	34.6%	63.5%	0.9%
Greece	474 (3.8)	Secondary 1	Secondary 2	3.1%	11.2%	84.5%	1.2%
Thailand	483 (6.9)	Secondary 1	Secondary 2	18.0%	58.4%	19.6%	4.0%

*Data are extrapolated; students below the lower grade and above the upper grade were not included in the sample. Denmark, Sweden and Switzerland tested 3 grades.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Chapter 2

AVERAGE ACHIEVEMENT IN THE MATHEMATICS CONTENT AREAS

Recognizing that important curricular differences exist between and within countries is an important aspect of IEA studies, and TIMSS attempted to measure achievement in different areas within mathematics that would be useful in relating achievement to curriculum. After much deliberation, the mathematics test for the seventh and eighth grades was designed to enable reporting by six content areas.[1] These six content areas include:

- fractions and number sense
- geometry
- algebra
- data representation, analysis, and probability
- measurement
- proportionality

Following the discussion in this chapter about differences in average achievement for the TIMSS countries across the content areas, Chapter 3 contains further information about the types of items within each content area, including a range of five or six example items within each content area and the percent of correct responses on those items for each of the TIMSS countries.

HOW DOES ACHIEVEMENT DIFFER ACROSS MATHEMATICS CONTENT AREAS?

As we have seen in Chapter 1, there are substantial differences in achievement among the participating countries on the TIMSS mathematics test. Given that the mathematics test was designed to include items from different curricular areas, it is important to examine whether or not the participating countries have particular strengths and weaknesses in their achievement in these content areas.

This chapter uses an analysis based on the average percent of correct responses to items within each content area to address the question of whether or not countries performed at the same level in each of the content areas as they did on the mathematics test as a whole. Because additional resources and time would have been required to use the more complex IRT scaling methodology that served as the basis for the overall achievement estimates in Chapter 1, TIMSS could not generate scale scores for the six content areas for this report.[2]

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[1] Please see the test development section of Appendix A for more information about the process used to develop the TIMSS tests. Appendix B provides an analysis of the match between the test and curriculum in the different TIMSS countries and the effect of this match on the TIMSS results.

[2] TIMSS plans to generate IRT scale scores for the mathematics content areas for future reports.

Tables 2.1 and 2.2 provide the average percent of correct responses to items in the different content areas for the eighth- and seventh-grade students, respectively. The countries are listed in order of their average percent correct across all items in the test. As indicated by the numbers of items overall and in each content area, the overall test contains more fractions and number sense items (34%) and fewer proportionality items (7%). Thus, countries that did well on the items testing fractions and number sense were more likely to have higher overall scores than those that performed better in proportionality.[3]

The results for the average percent correct across all mathematics items are provided for each country primarily to provide a basis of comparison for performance in each of the content areas. For the purpose of comparing overall achievement between countries, it is preferable to use the results presented in Chapter 1.[4] It is interesting to note, however, that even though the relative standings of countries differ somewhat from Tables 1.1 and 1.2, the slight differences are well within the limits expected by sampling error and can be attributed to the differences in the methodologies used.

The data in each column show each country's average percent correct for items in that content area and the international average across all countries for the content area (shown as the last entry in the column). Looking down each of the columns, in turn, two findings become apparent. First, the countries that did well on the overall test generally did well in each of the various content areas, and those that did poorly overall also tended to do so in each of the content areas. There are differences between the relative standing of countries within each of the content areas and their overall standing, but these differences are small when sampling error is considered.

Second, the international averages show that the different content areas in the TIMSS test were not equally difficult for the students taking the test. Data representation, analysis, and probability was the least difficult content area for both grades. On average, the items in this content area were answered correctly by 62% of the eighth-graders and 57% of the seventh-graders across countries. Internationally, the proportionality items (international averages of 45% at eighth grade and 40% at seventh grade) were the most difficult items for the students at both grades.

It is important to keep these differences in average difficulty in mind when reading across the rows of the table. These differences mean that for many countries, students will appear to have higher than average performance in data representation, analysis, and probability and lower than average performance in proportionality. For example, even the eighth-grade students in Singapore, who performed above the international average for the area of proportionality by a substantial margin, still

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[3] Table A.1 in Appendix A provides details about the distributions of items across the content areas, by format and score points (taking into account multi-part items and items scored for partial credit).

[4] The IRT scale scores provide better estimates of overall achievement, because they take the difficulty of items into account. This is important in a study such as TIMSS, where different students take overlapping but somewhat different sets of items.

Table 2.1

Average Percent Correct by Mathematics Content Areas Upper Grade (Eighth Grade*)

Country	Mathematics Overall (151 items)	Fractions & Number Sense (51 items)	Geometry (23 items)	Algebra (27 items)	Data Representation, Analysis & Probability (21 items)	Measurement (18 items)	Proportionality (11 items)
Singapore	79 (0.9)	84 (0.8)	76 (1.0)	76 (1.1)	79 (0.8)	77 (1.0)	75 (1.0)
Japan	73 (0.4)	75 (0.4)	80 (0.4)	72 (0.6)	78 (0.4)	67 (0.5)	61 (0.5)
Korea	72 (0.5)	74 (0.5)	75 (0.6)	69 (0.6)	78 (0.6)	66 (0.7)	62 (0.6)
Hong Kong	70 (1.4)	72 (1.4)	73 (1.5)	70 (1.5)	72 (1.3)	65 (1.7)	62 (1.4)
† Belgium (Fl)	66 (1.4)	71 (1.2)	64 (1.5)	63 (1.7)	73 (1.3)	60 (1.3)	53 (1.8)
Czech Republic	66 (1.1)	69 (1.1)	66 (1.1)	65 (1.3)	68 (0.9)	62 (1.2)	52 (1.3)
Slovak Republic	62 (0.8)	66 (0.8)	63 (0.8)	62 (0.9)	62 (0.7)	60 (0.9)	49 (1.0)
[1] Switzerland	62 (0.6)	67 (0.7)	60 (0.8)	53 (0.7)	72 (0.7)	61 (0.8)	52 (0.7)
Hungary	62 (0.7)	65 (0.8)	60 (0.8)	63 (0.9)	66 (0.7)	56 (0.8)	47 (0.9)
France	61 (0.8)	64 (0.8)	66 (0.8)	54 (1.0)	71 (0.8)	57 (0.9)	49 (0.9)
Russian Federation	60 (1.3)	62 (1.2)	63 (1.4)	63 (1.5)	60 (1.2)	56 (1.5)	48 (1.5)
Canada	59 (0.5)	64 (0.6)	58 (0.6)	54 (0.7)	69 (0.5)	51 (0.7)	48 (0.7)
Ireland	59 (1.2)	65 (1.2)	51 (1.3)	53 (1.3)	69 (1.1)	53 (1.3)	51 (1.2)
Sweden	56 (0.7)	62 (0.8)	48 (0.7)	44 (0.9)	70 (0.7)	56 (0.9)	44 (0.9)
New Zealand	54 (1.0)	57 (1.1)	54 (1.1)	49 (1.1)	66 (1.0)	48 (1.2)	42 (1.0)
Norway	54 (0.5)	58 (0.6)	51 (0.6)	45 (0.7)	66 (0.6)	51 (0.6)	40 (0.6)
†[2] England	53 (0.7)	54 (0.8)	54 (1.0)	49 (0.9)	66 (0.7)	50 (0.9)	41 (1.1)
† United States	53 (1.1)	59 (1.1)	48 (1.2)	51 (1.2)	65 (1.1)	40 (1.1)	42 (1.1)
[1] Latvia (LSS)	51 (0.8)	53 (0.9)	57 (0.8)	51 (0.9)	56 (0.8)	47 (0.9)	39 (0.9)
Spain	51 (0.5)	52 (0.5)	49 (0.6)	54 (0.8)	60 (0.7)	44 (0.7)	40 (0.8)
Iceland	50 (1.1)	54 (1.2)	51 (1.4)	40 (1.3)	63 (1.1)	45 (1.4)	38 (1.4)
[1] Lithuania	48 (0.9)	51 (1.0)	53 (1.1)	47 (1.2)	52 (1.0)	43 (0.9)	35 (0.9)
Cyprus	48 (0.5)	50 (0.6)	47 (0.6)	48 (0.7)	53 (0.6)	44 (0.9)	40 (0.7)
Portugal	43 (0.7)	44 (0.7)	44 (0.8)	40 (0.8)	54 (0.7)	39 (0.7)	32 (0.8)
Iran, Islamic Rep.	38 (0.6)	39 (0.6)	43 (0.8)	37 (0.8)	41 (0.6)	29 (1.2)	36 (0.8)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):							
Australia	58 (0.9)	61 (0.9)	57 (1.0)	55 (1.0)	67 (0.8)	54 (1.0)	47 (0.9)
Austria	62 (0.8)	66 (0.8)	57 (1.0)	59 (0.8)	68 (0.8)	62 (1.0)	49 (0.9)
Belgium (Fr)	59 (0.9)	62 (1.0)	58 (1.0)	53 (1.1)	68 (1.0)	56 (1.0)	48 (0.9)
Bulgaria	60 (1.2)	60 (1.4)	65 (1.3)	62 (1.5)	62 (1.1)	54 (1.6)	47 (1.5)
Netherlands	60 (1.6)	62 (1.6)	59 (1.8)	53 (1.6)	72 (1.7)	57 (1.6)	51 (1.9)
Scotland	52 (1.3)	53 (1.3)	52 (1.4)	46 (1.5)	65 (1.3)	48 (1.6)	40 (1.4)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):							
Colombia	29 (0.8)	31 (0.9)	29 (0.9)	28 (0.9)	37 (1.0)	25 (1.5)	23 (0.9)
†[1] Germany	54 (1.1)	58 (1.1)	51 (1.4)	48 (1.3)	64 (1.2)	51 (1.1)	42 (1.3)
Romania	49 (1.0)	48 (1.0)	52 (0.9)	52 (1.3)	49 (1.0)	48 (1.1)	42 (1.2)
Slovenia	61 (0.7)	63 (0.7)	60 (0.9)	61 (0.8)	66 (0.7)	59 (0.9)	49 (0.8)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):							
Denmark	52 (0.7)	53 (0.9)	54 (0.9)	45 (0.7)	67 (0.9)	49 (1.0)	41 (0.8)
Greece	49 (0.7)	53 (0.8)	51 (0.7)	46 (0.8)	56 (0.8)	43 (0.9)	39 (1.1)
Thailand	57 (1.4)	60 (1.5)	62 (1.3)	53 (1.7)	63 (1.1)	50 (1.4)	51 (1.5)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):							
[1] Israel	57 (1.3)	60 (1.4)	57 (1.4)	61 (1.6)	63 (1.3)	48 (1.6)	43 (1.6)
Kuwait	30 (0.7)	27 (0.8)	38 (1.0)	30 (1.0)	38 (1.0)	23 (1.0)	21 (0.7)
South Africa	24 (1.1)	26 (1.4)	24 (1.0)	23 (1.1)	26 (1.2)	18 (1.1)	21 (0.9)
International Average Percent Correct	55 (0.1)	58 (0.1)	56 (0.1)	52 (0.2)	62 (0.1)	51 (0.1)	45 (0.2)

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

† Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 2.2

Average Percent Correct by Mathematics Content Areas
Lower Grade (Seventh Grade*)

Country	Mathematics Overall (151 items)	Fractions & Number Sense (51 items)	Geometry (23 items)	Algebra (27 items)	Data Representation, Analysis & Probability (21 items)	Measurement (24 items)	Proportionality (11 items)
Singapore	73 (1.3)	79 (1.2)	69 (1.4)	68 (1.4)	72 (1.2)	70 (1.5)	71 (1.4)
Japan	67 (0.4)	71 (0.4)	70 (0.4)	64 (0.6)	73 (0.5)	62 (0.6)	55 (0.6)
Korea	67 (0.6)	70 (0.6)	70 (0.7)	64 (0.7)	73 (0.5)	62 (0.8)	55 (0.7)
Hong Kong	65 (1.8)	67 (1.7)	68 (1.9)	66 (2.0)	69 (1.5)	62 (2.0)	55 (1.7)
† Belgium (Fl)	65 (0.8)	72 (0.8)	59 (0.9)	60 (1.0)	73 (0.9)	59 (1.0)	54 (1.0)
Czech Republic	57 (1.2)	61 (1.4)	58 (1.1)	55 (1.2)	61 (1.1)	55 (1.2)	41 (1.3)
† Belgium (Fr)	54 (0.9)	59 (1.0)	55 (1.0)	44 (1.0)	64 (1.0)	53 (1.0)	44 (1.0)
Slovak Republic	54 (0.8)	58 (0.9)	57 (0.8)	50 (1.0)	56 (0.7)	52 (1.0)	41 (1.0)
Hungary	54 (0.8)	59 (0.9)	52 (0.9)	52 (1.1)	60 (0.8)	49 (1.0)	38 (1.0)
Ireland	53 (1.0)	62 (1.1)	43 (0.9)	47 (1.1)	64 (0.9)	46 (1.1)	46 (1.1)
¹ Switzerland	53 (0.5)	60 (0.7)	46 (0.6)	41 (0.6)	65 (0.7)	53 (0.8)	44 (0.7)
Russian Federation	53 (0.9)	56 (1.0)	55 (1.2)	55 (1.0)	55 (1.0)	47 (1.0)	40 (1.1)
Canada	52 (0.5)	58 (0.6)	50 (0.7)	43 (0.7)	63 (0.6)	44 (0.6)	42 (0.7)
France	51 (0.8)	53 (0.8)	58 (0.9)	39 (0.8)	63 (0.8)	49 (1.0)	41 (1.0)
† United States	48 (1.2)	54 (1.4)	44 (1.1)	44 (1.3)	60 (1.2)	36 (1.4)	38 (1.2)
†² England	47 (0.9)	48 (1.0)	49 (0.9)	41 (1.0)	62 (0.9)	43 (0.9)	38 (1.0)
Sweden	47 (0.6)	51 (0.8)	43 (0.6)	35 (0.6)	64 (0.9)	47 (0.7)	36 (0.8)
New Zealand	46 (0.9)	50 (0.9)	46 (1.1)	39 (0.9)	59 (1.0)	40 (1.0)	38 (1.0)
† Scotland	44 (0.9)	47 (1.0)	46 (1.1)	36 (0.8)	58 (1.0)	40 (0.9)	34 (0.8)
Norway	44 (0.7)	49 (0.9)	42 (0.7)	32 (0.7)	59 (0.9)	44 (0.9)	34 (0.7)
¹ Latvia (LSS)	44 (0.7)	46 (0.8)	48 (0.8)	43 (1.0)	49 (0.8)	41 (0.8)	33 (1.0)
Iceland	43 (0.7)	49 (1.0)	47 (0.7)	31 (0.6)	56 (0.8)	38 (0.8)	33 (0.7)
Spain	42 (0.6)	43 (0.6)	43 (0.7)	41 (0.7)	52 (0.7)	38 (0.7)	35 (0.7)
Cyprus	42 (0.4)	46 (0.5)	43 (0.6)	39 (0.5)	48 (0.6)	34 (0.5)	36 (0.7)
¹ Lithuania	38 (0.8)	41 (0.9)	38 (1.0)	38 (1.0)	44 (0.9)	32 (0.9)	25 (0.7)
Portugal	37 (0.6)	39 (0.6)	38 (0.8)	31 (0.7)	46 (0.6)	34 (0.7)	25 (0.6)
Iran, Islamic Rep.	32 (0.5)	34 (0.6)	40 (0.9)	28 (0.6)	36 (0.7)	23 (0.7)	30 (0.7)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):							
Australia	52 (0.8)	56 (0.9)	52 (0.8)	47 (1.0)	63 (0.9)	48 (1.0)	41 (0.9)
Austria	56 (0.7)	61 (0.8)	52 (0.9)	48 (0.8)	63 (0.8)	55 (0.8)	44 (1.0)
Bulgaria	55 (1.7)	56 (1.8)	61 (1.8)	58 (2.2)	56 (1.1)	52 (1.8)	44 (2.1)
Netherlands	55 (1.0)	60 (1.2)	54 (1.1)	42 (1.0)	69 (1.0)	52 (1.2)	51 (1.2)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):							
Colombia	26 (0.6)	28 (0.7)	26 (0.9)	24 (0.8)	32 (0.8)	22 (0.7)	21 (0.9)
†¹ Germany	49 (1.0)	55 (1.2)	46 (1.1)	39 (1.4)	61 (1.1)	46 (0.9)	37 (1.0)
Romania	43 (0.8)	43 (0.8)	48 (1.0)	46 (1.0)	44 (0.7)	42 (1.1)	35 (0.9)
Slovenia	53 (0.7)	56 (0.7)	52 (0.8)	48 (0.8)	60 (0.7)	50 (0.8)	39 (0.9)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):							
Denmark	44 (0.5)	45 (0.7)	46 (0.8)	36 (0.7)	59 (0.8)	41 (0.7)	34 (0.7)
Greece	40 (0.6)	47 (0.7)	39 (0.7)	33 (0.7)	46 (0.7)	35 (0.8)	34 (0.7)
† South Africa	23 (0.9)	26 (1.1)	22 (0.9)	20 (0.8)	25 (1.1)	17 (1.0)	20 (0.8)
Thailand	52 (1.2)	56 (1.3)	57 (1.0)	45 (1.3)	57 (1.1)	44 (1.4)	46 (1.3)
International Average Percent Correct	49 (0.1)	53 (0.2)	49 (0.2)	44 (0.2)	57 (0.1)	45 (0.2)	40 (0.2)

*Seventh grade in most countries; See Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

¹National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

²National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

performed somewhat less well in this area than they did on the test as a whole. That is, simply comparing performance across the rows gives an unclear picture of each country's relative performance across the content areas because the differing difficulty of the items has not been taken into account.

To facilitate more meaningful comparisons across rows, TIMSS has developed profiles of relative performance, which are shown for both grades in Table 2.3. These profiles are designed to show whether participating countries performed better or worse in some content areas than they did on the test as a whole, after adjusting for the differing difficulty of the items in each of the content areas.[5] An up-arrow indicates that a country did significantly better in a content area than it did on the test as a whole, a down-arrow indicates significantly lower performance, and a circle indicates that the country's performance in a content area is not very different from its performance on the test as a whole.[6]

The profiles in Table 2.3 reveal that many countries performed relatively better or worse in several content areas than they did overall. Except in the Netherlands at the seventh grade, each country had at least one content area in which it did relatively better or worse than it did on average. Although countries that did well in one content area tended to do well in others, there were still significant performance differences by content area among countries. For example, countries that performed relatively better in fractions and number sense often were different from those that performed relatively better in geometry and algebra. Also, although there were some differences between the two grades, relative performance tended to be similar at both the seventh and eighth grades.

Singapore, Belgium (Flemish), Hungary, Ireland, Switzerland, Canada, the United States, and Germany all performed relatively better in fractions and number sense than they did on the test as a whole at both grades. The countries performing relatively better in geometry at both grades included Japan, Korea, Hong Kong, the Russian Federation, France, Latvia (LSS), Iran, Romania, and Thailand. In algebra, the countries performing relatively better at both grades were Japan, Hong Kong, the Czech Republic, the Slovak Republic, Hungary, the Russian Federation, Spain, Cyprus, Romania, and South Africa. This is consistent with the existence of differing curricular patterns and

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[5] Since the items in the different content areas varied in difficulty, the first step was to adjust the average percents to make all content areas equally difficult so that the comparisons would not reflect the various difficulties of the items in the content areas. The next step was to subtract these adjusted percentages for each content area from a country's average percentage over all six content areas. If the overall percentage of correct items by students in a country was the same as the adjusted average for that country for each of the content areas, then these differences would all be zero. The standard errors for these differences were computed, and then each difference was examined for statistical significance. This approach is similar to testing interaction terms in the analysis of variance. The jackknife method was used to compute the standard error of each interaction term. The significance level was adjusted using the Bonferroni method, assuming 6x41 (content areas by countries) comparisons at the eighth grade and 6x39 at the seventh grade.

[6] The statistics are not independent. That is, a country cannot do better (or worse) than its average on all scales, since a country's differences must add up to zero. However, it is possible for a country to have no statistically significant differences in performance.

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approaches among countries as discussed in the curriculum analysis report, *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Mathematics.*[7] This report indicates that a number of the Pacific Rim and Eastern European countries focus on geometry and algebra during the middle-school years.

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[7] Schmidt, W.H., McKnight, C.C., Valverde, G. A., Houang, R.T., and Wiley, D. E. (in press). *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Mathematics.* Dordrecht, the Netherlands: Kluwer Academic Publishers.

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Table 2.3

Profiles of Relative Performance in Mathematics Content Areas - Lower and Upper Grades (Seventh and Eighth Grades*) - Indicators of Statistically Significant Differences from Overall Percent Correct Adjusted for the Difficulty of the Content Areas

Seventh Grade

Country	Fractions & Number Sense	Geometry	Algebra	Data Rep., Analy. & Probability	Measurement	Proportionality
Singapore	▲	▼	●	▼	▲	▲
Japan	●	▲	▲	▼	●	▼
Korea	●	▲	▲	▼	●	▼
Hong Kong	▼	▲	▲	▼	●	●
[†] Belgium (Fl)	▲	▼	●	●	●	●
Czech Republic	●	●	▲	▼	▲	▼
[†] Belgium (Fr)	●	●	▼	●	▲	●
Slovak Republic	●	▲	▲	▼	▲	▼
Hungary	▲	●	▲	●	●	▼
Ireland	▲	▼	●	▲	▼	▲
[1] Switzerland	▲	▼	▼	▲	▲	●
Russian Federation	●	▲	▲	▼	●	▼
Canada	▲	●	▼	▲	▼	●
France	▼	▲	▼	▲	●	●
[†] United States	▲	▼	▲	▲	▼	●
[†2] England	▼	●	●	▲	●	●
Sweden	●	▼	▼	▲	▲	▼
New Zealand	●	●	▼	▲	▼	●
[†] Scotland	▼	●	▼	▲	●	●
Norway	●	▼	▼	▲	▲	●
[1] Latvia (LSS)	▼	▲	▲	▼	●	▼
Iceland	●	▲	▼	▲	●	●
Spain	▼	●	▲	●	●	▲
Cyprus	●	●	▲	▼	▼	▲
[1] Lithuania	●	●	▲	▼	●	▼
Portugal	▼	●	●	▲	●	▼
Iran, Islamic Rep.	▼	▲	●	▼	▼	▲
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	▲	▼	●	●	▲	●
Austria	▼	▲	▲	▼	●	●
Bulgaria	●	▼	▼	▲	●	▲
Netherlands	●	●	●	●	●	●
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	▼	●	▲	▼	●	▲
[†1] Germany	▲	▼	▼	▲	▲	▼
Romania	▼	▲	▲	▼	●	●
Slovenia	●	●	●	●	▲	▼
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	▼	●	▼	▲	●	●
Greece	▲	●	▼	▼	●	▲
[†] South Africa	●	▼	▲	▼	▼	▲
Thailand	●	▲	▼	▼	▼	▲
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):						

Eighth Grade

Country	Fractions & Number Sense	Geometry	Algebra	Data Rep., Analy. & Probability	Measurement	Proportionality
Singapore	▲	▼	●	▼	▲	▲
Japan	▼	▲	▲	▼	▼	▼
Korea	●	▲	●	●	●	●
Hong Kong	●	▲	▲	▼	●	▲
[†] Belgium (Fl)	▲	▼	●	●	●	▼
Czech Republic	●	●	▲	▼	▲	▼
Slovak Republic	▲	●	▲	▼	▲	▼
[1] Switzerland	▲	▼	▼	▲	▲	●
Hungary	▲	●	▲	▼	●	▼
France	●	▲	▼	▲	●	▼
Russian Federation	●	▲	▲	▼	●	●
Canada	▲	●	▼	▲	▼	●
Ireland	▲	▼	▼	▲	●	▲
Sweden	▲	▼	▼	▲	▲	●
New Zealand	●	●	▼	▲	●	●
Norway	▲	▼	▼	▲	▲	▼
[†2] England	▼	●	▼	▲	●	●
[†] United States	▲	▼	●	▲	▼	●
[1] Latvia (LSS)	▼	▲	●	▼	●	▼
Spain	▼	▼	▲	●	▼	●
Iceland	▲	●	▼	▲	●	●
[1] Lithuania	●	▲	●	▼	●	▼
Cyprus	●	●	▲	▼	●	●
Portugal	▼	●	●	▲	●	●
Iran, Islamic Rep.	▼	▲	●	▼	▼	▲
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	●	▼	●	▲	●	●
Austria	▲	▼	●	●	▲	▼
Belgium (Fr)	●	●	▼	▲	▲	●
Bulgaria	▼	▲	▲	▼	●	●
Netherlands	●	●	▼	▲	●	●
Scotland	▼	●	▼	▲	●	●
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	●	●	●	●	●	▲
[†1] Germany	▲	▼	▼	▲	▲	●
Romania	▼	▲	▲	▼	▲	▲
Slovenia	●	●	▲	▼	▲	●
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	▼	●	▼	▲	●	●
Greece	●	●	●	●	▼	●
Thailand	●	▲	▼	▼	▼	▲
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):						
[1] Israel	●	●	▲	●	▼	▼
Kuwait	▼	▲	●	●	▼	●
South Africa	●	●	▲	▼	▼	▲

▲= Significantly higher than overall average ●= No significant difference from overall average ▼= Significantly lower than overall average

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*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

[†] Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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WHAT ARE THE INCREASES IN ACHIEVEMENT BETWEEN THE LOWER AND UPPER GRADES?

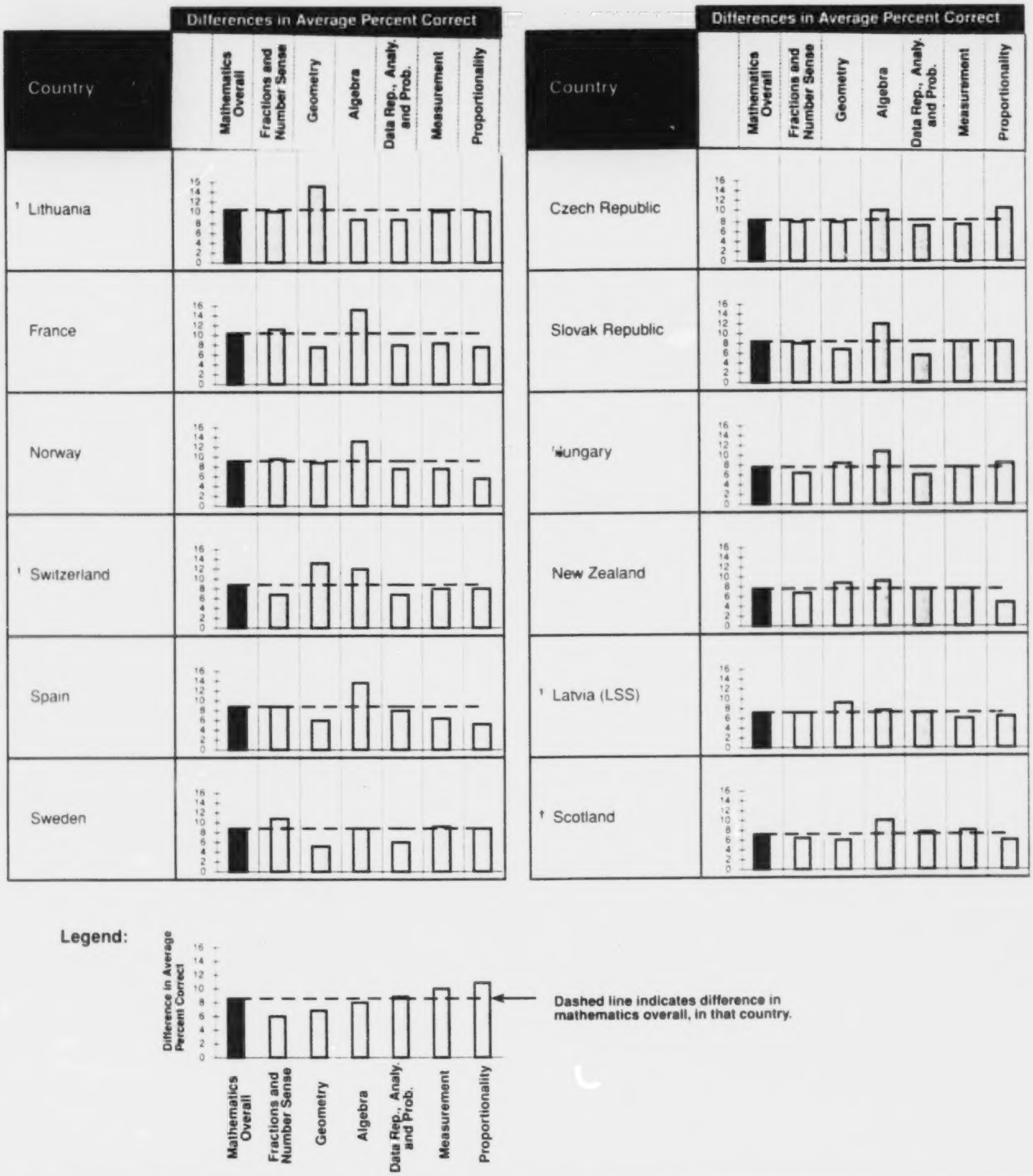
Figure 2.1, which profiles the increases in average percent correct between the seventh and eighth grade for each country across content areas, also reflects these curricular differences. The figure portrays the degree of the increase in mathematics achievement overall as well as the increase in achievement for each of the six content areas. The dashed line indicates the overall increase, for ease in comparing the growth within content areas against the growth in performance overall. The results are presented in descending order by the amount of overall increase between the grades, beginning with Lithuania, France, and Norway, all three of which showed the greatest increases (about 10%).

The results show that the degree of increase across the different content areas was uneven in most countries, generally reflecting a greater emphasis in the curriculum on some areas compared to others during the eighth grade. There were several countries, however, where the increases in the content areas were similar to the overall between-grade increase across most content areas, including Latvia (LSS), the United States, Korea, Hong Kong, and Denmark, for example.

In general, performance in geometry and algebra showed the largest growth between the seventh and eighth grades. This is most noticeable in geometry for Lithuania and Switzerland. France, Norway, Switzerland, Spain, the Slovak Republic, and Hungary were among those countries showing higher-than-average between-grade increases in algebra. In general, the growth in data representation, analysis, and probability was quite similar or somewhat below the average between-grade increase. Fractions and number sense often showed a smaller-than-average increase compared to that overall, presumably because this content area was no longer emphasized in the middle-school curriculum in many countries. The smaller-than-average increases in the area of proportionality most likely reflect a general lack of special emphasis in this area.

Figure 2.1

Difference in Average Percent Correct Between Lower and Upper Grades (Seventh and Eighth Grades*) Overall and in Mathematics Content Areas



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*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

‡National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

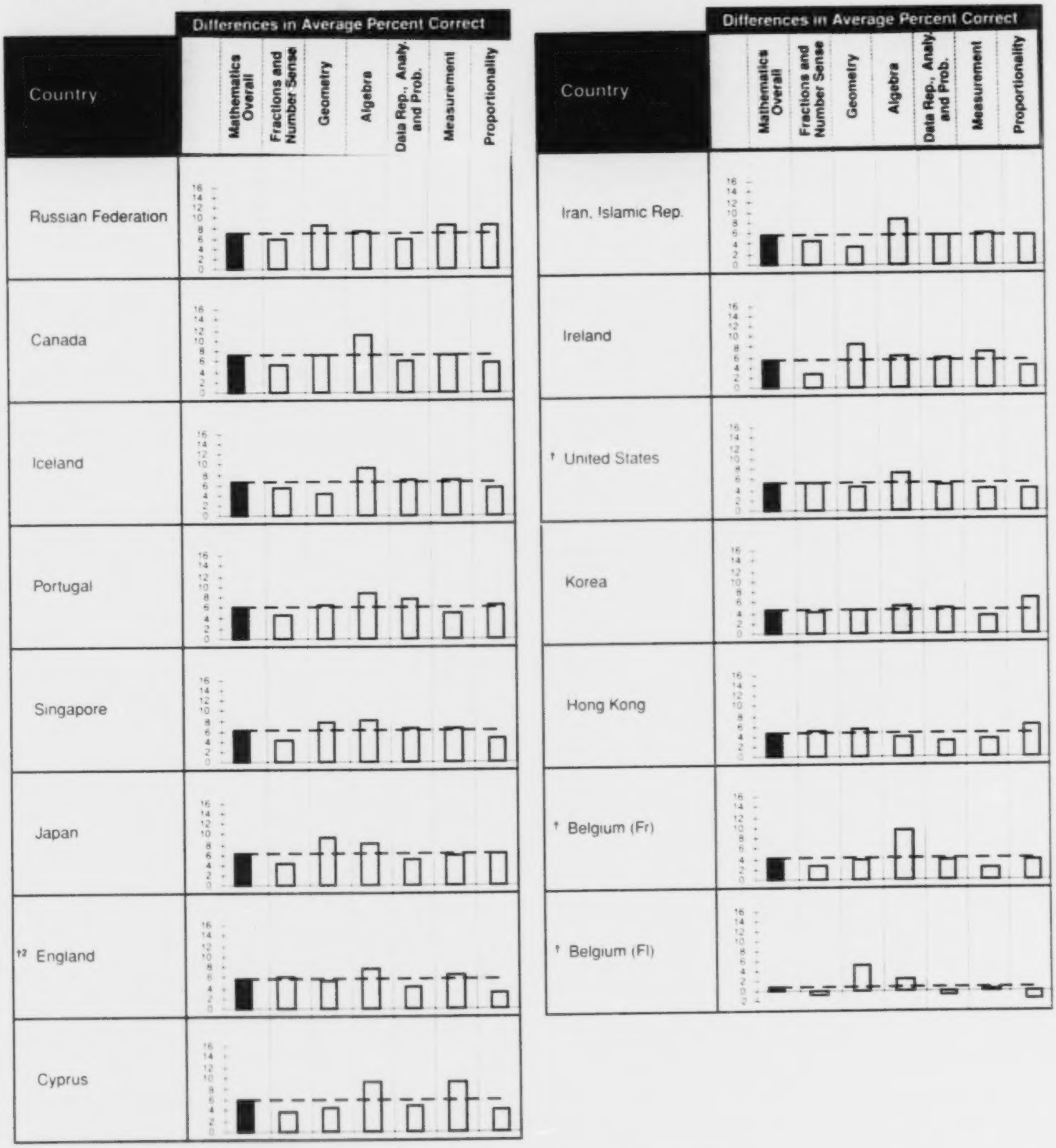
¹National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 2.1 (Continued-2)

Difference in Average Percent Correct Between Lower and Upper Grades (Seventh and Eighth Grades*) Overall and in Mathematics Content Areas



*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

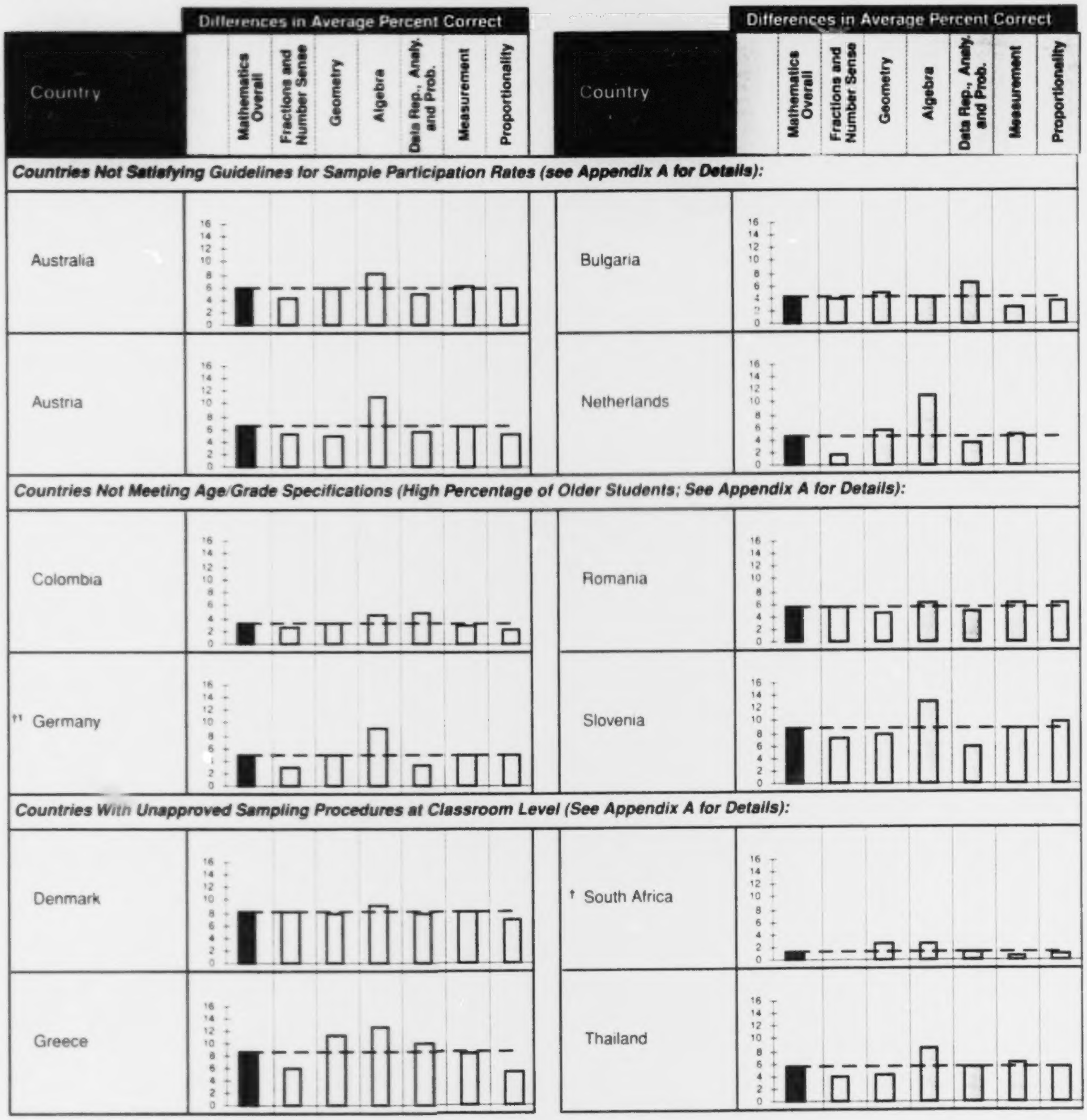
[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 2.1 (Continued-3)

Difference in Average Percent Correct Between Lower and Upper Grades (Seventh and Eighth Grades*) Overall and in Mathematics Content Areas



*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

¹National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

²National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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WHAT ARE THE GENDER DIFFERENCES IN ACHIEVEMENT FOR THE CONTENT AREAS?

Tables 2.4 and 2.5 indicate few statistically significant gender differences in achievement by content areas. However, the reduced number of gender differences in performance overall compared to the differences in scale scores discussed in Chapter 1 reinforces the idea of less precision in the percent-correct metric. Still, the findings are consistent — few gender differences, but the differences that do exist tended to favor boys. The exception from the pattern occurred in algebra, where, if anything, girls tended to have the advantage.

In fractions and number sense, the gender differences at both grades were minimal in all countries except Korea, where the eighth-grade boys showed a significant advantage. Similarly, boys and girls performed about the same in the content area of geometry at both grades. The exception was Greece, where the eighth-grade boys performed significantly better than the girls did.

In algebra, no gender differences were statistically significant at the eighth grade, but the results appeared to be more diverse, with girls having slightly higher averages (3 percentage points or more) than boys in a dozen or so countries. At the seventh grade, the pattern was similar, and girls performed significantly better than boys in Canada and Lithuania.

Boys and girls performed similarly on the items in the content area of data representation, analysis, and probability, except in a few countries where boys appeared to outperform girls. The only significant differences were in Korea, where the boys outperformed the girls at both grades.

The most differences in performance by gender were found in measurement where boys had higher achievement than did girls in a number of countries. At the eighth grade, the differences were statistically significant in Korea, Portugal, Spain, and Denmark. At the seventh grade, a significant difference was found in Iran.

Results in the area of proportionality paralleled those in fractions and number sense, with boys and girls performing similarly in most countries. There were no significant gender differences at the eighth grade. At the seventh grade, boys performed better than girls in Iceland, Japan, and Denmark.

In some respects, the TIMSS findings about gender differences parallel those found in the Second International Mathematics Study (SIMS) conducted in 1980-82.[8] Based on testing the grade with the most 13-year-old students, SIMS results indicated that girls were more likely to achieve better than boys in computation-level arithmetic, whole numbers, estimation and approximation, and algebra. Boys tended to be better in measurement, geometry, and proportional thinking. Even though the SIMS gender differences in arithmetic, geometry, and proportional thinking did not appear in the

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[8] Robitaille, D.F. (1989). "Students' Achievements: Population A" in D.F. Robitaille, and R.A. Garden (eds.) *The IEA Study of Mathematics II: Contexts and Outcomes of School Mathematics.* New York: Pergamon Press.

TIMSS results, the patterns of higher achievement for girls in algebra and of higher achievement for boys in measurement are consistent from the second to the third IEA mathematics studies. In the SIMS report, the authors suggested that "boys' familiarity with the application of, and relationships between, units of measure may well be related to their link with traditionally male occupations, hobbies, and pastimes, and the gender differences for this subtest may underline the effect that experience can have on learning." This potential explanation for boys' advantage in the content area of measurement may also be worth considering in the context of the TIMSS data.

Table 2.4

Average Percent Correct for Boys and Girls by Mathematics Content Areas Upper Grade (Eighth Grade*)

Country	Mathematics Overall		Fractions & Number Sense		Geometry		Algebra	
† Belgium (Fl)	65 (2.0)	66 (1.9)	71 (1.8)	72 (1.7)	63 (2.1)	64 (2.1)	60 (2.5)	65 (2.4)
Canada	59 (0.7)	59 (0.6)	63 (0.8)	64 (0.7)	58 (0.9)	58 (0.7)	52 (0.9)	55 (1.0)
Cyprus	47 (0.6)	48 (0.6)	50 (0.7)	50 (0.8)	47 (0.9)	48 (0.8)	46 (0.9)	49 (1.0)
Czech Republic	67 (1.0)	64 (1.3)	70 (1.1)	68 (1.3)	68 (1.1)	65 (1.4)	64 (1.4)	66 (1.4)
†2 England	53 (1.3)	53 (0.9)	54 (1.3)	53 (1.0)	54 (1.5)	54 (1.3)	47 (1.6)	51 (1.1)
France	62 (0.8)	61 (0.9)	65 (0.9)	64 (1.0)	67 (1.0)	65 (1.1)	54 (1.1)	54 (1.3)
Hong Kong	72 (1.7)	68 (1.7)	74 (1.7)	70 (1.7)	74 (1.8)	71 (1.9)	71 (1.8)	69 (2.0)
Hungary	61 (0.8)	62 (0.8)	64 (1.0)	65 (0.9)	61 (1.0)	60 (1.0)	61 (1.0)	66 (1.1)
Iceland	49 (1.3)	50 (1.3)	54 (1.8)	55 (1.4)	50 (1.3)	52 (1.6)	39 (1.1)	41 (1.9)
Iran, Islamic Rep.	39 (0.8)	36 (0.8)	40 (0.9)	37 (0.8)	45 (1.1)	40 (1.2)	36 (0.9)	38 (1.2)
Ireland	60 (1.6)	58 (1.4)	65 (1.7)	64 (1.5)	54 (1.7)	49 (1.6)	54 (1.7)	53 (1.7)
Japan	74 (0.5)	73 (0.4)	76 (0.6)	75 (0.5)	79 (0.6)	80 (0.5)	72 (0.7)	72 (0.7)
Korea	▲ 73 (0.6)	70 (0.7)	▲ 76 (0.7)	72 (0.8)	77 (0.8)	73 (0.8)	70 (0.8)	69 (0.9)
1 Latvia (LSS)	52 (1.0)	51 (0.8)	53 (1.2)	53 (1.0)	58 (1.0)	56 (1.1)	50 (1.3)	51 (0.9)
1 Lithuania	48 (1.1)	49 (1.0)	51 (1.2)	52 (1.2)	54 (1.2)	53 (1.2)	45 (1.5)	49 (1.4)
New Zealand	55 (1.4)	53 (1.3)	58 (1.4)	55 (1.3)	54 (1.5)	55 (1.4)	48 (1.5)	49 (1.3)
Norway	54 (0.6)	53 (0.6)	58 (0.7)	58 (0.7)	50 (0.8)	51 (0.9)	44 (0.9)	46 (0.9)
Portugal	44 (0.8)	42 (0.7)	45 (0.9)	42 (0.8)	46 (1.2)	42 (0.9)	39 (1.0)	40 (1.0)
Russian Federation	59 (1.4)	61 (1.3)	61 (1.5)	62 (1.1)	62 (1.7)	64 (1.4)	61 (1.8)	64 (1.3)
Singapore	79 (1.1)	79 (1.0)	83 (1.0)	84 (0.8)	76 (1.3)	77 (1.2)	75 (1.3)	77 (1.3)
Slovak Republic	63 (0.9)	62 (0.8)	66 (1.0)	66 (0.8)	65 (0.9)	62 (1.0)	60 (1.1)	64 (1.0)
Spain	52 (0.7)	50 (0.7)	53 (0.7)	51 (0.7)	51 (0.8)	48 (0.8)	54 (1.0)	54 (0.9)
Sweden	56 (0.8)	56 (0.8)	62 (0.9)	62 (0.9)	48 (0.8)	49 (0.8)	43 (1.0)	45 (1.1)
† Switzerland	63 (0.8)	61 (0.7)	67 (0.8)	66 (0.9)	60 (1.1)	59 (0.9)	53 (1.1)	53 (0.9)
† United States	53 (1.2)	53 (1.1)	60 (1.3)	59 (1.2)	49 (1.4)	47 (1.1)	50 (1.4)	51 (1.2)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):								
Australia	57 (1.2)	59 (1.1)	60 (1.2)	61 (1.1)	57 (1.3)	58 (1.2)	53 (1.3)	57 (1.2)
Austria	63 (0.8)	61 (1.2)	67 (0.9)	65 (1.1)	57 (1.3)	57 (1.4)	59 (0.9)	60 (1.2)
Belgium (Fr)	59 (1.1)	58 (1.0)	62 (1.4)	62 (0.9)	60 (1.3)	57 (1.1)	52 (1.6)	55 (1.3)
Netherlands	61 (1.8)	59 (1.6)	63 (1.8)	60 (1.7)	61 (2.1)	58 (1.8)	52 (1.8)	53 (1.8)
Scotland	53 (1.7)	50 (1.3)	55 (1.5)	51 (1.3)	54 (1.8)	50 (1.4)	46 (2.0)	46 (1.4)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):								
Colombia	30 (1.6)	29 (0.9)	31 (1.8)	30 (0.7)	29 (1.6)	29 (1.1)	28 (1.7)	28 (1.0)
†1 Germany	54 (1.3)	54 (1.2)	60 (1.3)	57 (1.3)	51 (1.5)	53 (1.5)	47 (1.5)	49 (1.4)
Romania	49 (1.1)	49 (1.0)	48 (1.2)	48 (1.0)	53 (1.1)	51 (1.1)	50 (1.5)	54 (1.2)
Slovenia	62 (0.8)	60 (0.7)	64 (0.9)	62 (0.8)	61 (1.1)	59 (1.1)	61 (1.0)	61 (0.9)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):								
Denmark	▲ 54 (0.8)	50 (0.9)	55 (1.0)	51 (1.1)	56 (1.1)	53 (1.3)	47 (0.8)	44 (1.0)
Greece	51 (0.9)	48 (0.7)	54 (1.0)	51 (0.8)	▲ 53 (0.9)	48 (0.9)	46 (1.0)	46 (0.9)
Thailand	56 (1.4)	58 (1.7)	59 (1.5)	61 (1.8)	60 (1.3)	63 (1.5)	51 (1.8)	55 (2.0)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):								
1 Israel	61 (1.5)	55 (1.5)	64 (1.6)	58 (1.6)	61 (1.3)	55 (1.8)	63 (1.7)	59 (1.9)
South Africa	25 (1.7)	22 (1.0)	28 (2.0)	24 (1.2)	25 (1.6)	24 (0.9)	24 (1.5)	23 (1.2)

▲ = Difference from other gender statistically significant at .05 level, adjusted for multiple comparisons

*Eighth grade in most countries; See Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 2.4 (Continued)

Average Percent Correct for Boys and Girls by Mathematics Content Areas Upper Grade (Eighth Grade*)

Country	Data Representation, Analysis & Probability		Measurement		Proportionality	
[†] Belgium (Fl)	72 (2.2)	73 (1.4)	60 (1.9)	59 (2.0)	52 (2.2)	53 (2.7)
Canada	69 (0.9)	69 (0.6)	52 (0.9)	50 (0.8)	48 (0.9)	48 (1.0)
Cyprus	52 (0.9)	54 (0.9)	44 (1.1)	43 (1.1)	40 (1.0)	39 (0.9)
Czech Republic	70 (0.9)	67 (1.4)	64 (1.2)	60 (1.5)	54 (1.4)	49 (1.7)
[†2] England	67 (1.2)	65 (1.1)	51 (1.5)	48 (1.1)	42 (1.5)	40 (1.3)
France	72 (0.8)	70 (1.1)	58 (1.0)	56 (1.1)	50 (1.2)	48 (1.2)
Hong Kong	73 (1.6)	69 (1.4)	68 (1.9)	62 (2.1)	63 (1.5)	60 (1.9)
Hungary	66 (0.9)	65 (0.9)	57 (1.0)	56 (1.0)	47 (1.2)	46 (1.1)
Iceland	63 (1.6)	62 (1.4)	45 (1.8)	45 (2.0)	40 (1.6)	37 (1.4)
Iran, Islamic Rep.	42 (0.8)	40 (0.9)	32 (1.7)	26 (1.4)	38 (1.3)	34 (1.1)
Ireland	70 (1.6)	68 (1.3)	55 (1.9)	51 (1.6)	52 (1.8)	49 (1.2)
Japan	79 (0.5)	77 (0.5)	68 (0.6)	67 (0.6)	62 (0.8)	60 (0.8)
Korea	▲ 80 (0.7)	75 (0.8)	▲ 69 (0.9)	62 (1.0)	62 (0.9)	61 (0.9)
[1] Latvia (LSS)	57 (1.0)	55 (1.0)	49 (1.2)	46 (1.1)	41 (1.1)	37 (1.0)
[1] Lithuania	52 (1.2)	52 (1.1)	44 (1.1)	41 (1.2)	34 (1.1)	35 (1.2)
New Zealand	67 (1.3)	65 (1.3)	50 (1.5)	46 (1.4)	44 (1.5)	40 (1.4)
Norway	67 (0.8)	66 (0.8)	53 (0.8)	50 (0.7)	41 (0.8)	40 (0.8)
Portugal	55 (0.9)	53 (0.8)	▲ 41 (0.9)	36 (0.8)	33 (1.0)	30 (0.9)
Russian Federation	60 (1.2)	60 (1.4)	56 (1.3)	56 (1.8)	48 (1.6)	49 (1.6)
Singapore	79 (1.1)	79 (1.0)	77 (1.3)	77 (1.0)	75 (1.2)	76 (1.1)
Slovak Republic	62 (0.9)	61 (0.8)	62 (1.1)	59 (1.0)	50 (1.1)	48 (1.3)
Spain	61 (0.8)	59 (0.8)	▲ 47 (1.0)	42 (0.9)	42 (1.1)	38 (0.9)
Sweden	70 (0.9)	69 (0.9)	57 (1.1)	55 (1.0)	46 (1.1)	43 (1.1)
[1] Switzerland	73 (1.0)	71 (0.7)	62 (1.0)	59 (1.0)	53 (1.0)	52 (0.9)
[†] United States	65 (1.1)	66 (1.2)	42 (1.2)	38 (1.2)	43 (1.1)	42 (1.2)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	66 (1.1)	69 (1.0)	54 (1.2)	53 (1.1)	47 (1.3)	46 (1.1)
Austria	69 (0.9)	68 (1.2)	64 (1.0)	60 (1.6)	50 (1.0)	48 (1.3)
Belgium (Fr)	69 (1.4)	67 (1.1)	56 (1.2)	55 (1.2)	49 (1.1)	46 (1.2)
Netherlands	74 (2.0)	70 (1.5)	58 (1.8)	56 (1.7)	54 (2.4)	49 (1.9)
Scotland	67 (1.6)	63 (1.3)	50 (2.0)	45 (1.4)	43 (1.7)	37 (1.4)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	38 (1.9)	36 (1.1)	25 (1.9)	25 (2.5)	24 (1.5)	22 (0.9)
[†1] Germany	65 (1.3)	64 (1.3)	52 (1.3)	50 (1.3)	44 (1.6)	41 (1.3)
Romania	49 (1.2)	48 (1.1)	49 (1.4)	47 (1.3)	41 (1.3)	42 (1.3)
Slovenia	67 (0.9)	65 (0.8)	60 (1.1)	57 (1.0)	50 (1.1)	48 (1.2)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	69 (1.0)	64 (1.3)	▲ 52 (1.0)	47 (1.2)	43 (1.2)	39 (0.9)
Greece	58 (1.2)	55 (0.8)	45 (1.0)	41 (1.0)	41 (1.3)	38 (1.1)
Thailand	62 (1.3)	63 (1.4)	50 (1.5)	51 (1.8)	50 (1.7)	52 (1.9)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):						
[1] Israel	67 (1.6)	60 (1.6)	52 (1.9)	46 (1.8)	48 (2.0)	40 (1.6)
South Africa	28 (1.9)	25 (1.1)	20 (1.8)	16 (1.0)	23 (1.4)	20 (0.9)

▲ = Difference from other gender statistically significant at .05 level, adjusted for multiple comparisons

*Eighth grade in most countries; See Table 2 for information about the grades tested in each country.

[†] Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 2.5

Average Percent Correct for Boys and Girls by Mathematics Content Areas Lower Grade (Seventh Grade*)

Country	Mathematics Overall		Fractions & Number Sense		Geometry		Algebra	
† Belgium (Fl)	**65 (1.1)**	**66 (1.1)**	**72 (1.1)**	**73 (1.0)**	**58 (1.2)**	**59 (1.3)**	**59 (1.5)**	**62 (1.2)**
† Belgium (Fr)	56 (1.0)	53 (1.1)	61 (1.2)	58 (1.2)	56 (1.4)	53 (1.4)	44 (1.1)	43 (1.3)
Canada	52 (0.6)	52 (0.6)	58 (0.6)	58 (0.7)	51 (1.0)	50 (0.8)	41 (0.8)	▲ 44 (0.8)
Cyprus	42 (0.6)	42 (0.5)	46 (0.7)	45 (0.6)	43 (0.9)	43 (0.9)	38 (0.8)	39 (0.8)
Czech Republic	58 (1.1)	57 (1.3)	62 (1.4)	60 (1.4)	59 (1.0)	58 (1.5)	54 (1.2)	57 (1.4)
†[2] England	49 (1.4)	45 (1.0)	49 (1.7)	46 (1.1)	51 (1.4)	47 (1.2)	42 (1.6)	40 (1.2)
France	52 (0.9)	50 (0.8)	54 (1.0)	52 (1.0)	59 (1.1)	57 (1.1)	39 (0.9)	39 (0.9)
Hong Kong	66 (2.2)	64 (2.0)	67 (2.2)	66 (1.9)	69 (2.4)	66 (2.0)	66 (2.5)	65 (2.3)
Hungary	53 (0.9)	54 (1.0)	58 (1.0)	59 (1.0)	53 (1.0)	51 (1.1)	50 (1.1)	54 (1.3)
Iceland	43 (0.7)	43 (0.7)	49 (1.1)	49 (0.9)	46 (1.0)	48 (0.8)	30 (0.6)	32 (0.8)
Iran, Islamic Rep.	33 (0.7)	31 (0.7)	35 (0.8)	33 (0.8)	41 (1.5)	38 (0.9)	29 (0.9)	28 (0.8)
Ireland	55 (1.5)	52 (1.1)	64 (1.6)	61 (1.3)	44 (1.4)	41 (1.1)	48 (1.7)	46 (1.4)
Japan	68 (0.6)	66 (0.4)	72 (0.5)	70 (0.5)	71 (0.7)	70 (0.5)	64 (0.7)	63 (0.7)
Korea	68 (0.8)	65 (0.9)	71 (0.8)	67 (1.0)	72 (1.0)	69 (1.1)	65 (1.1)	63 (1.1)
[1] Latvia (LSS)	44 (1.0)	44 (0.8)	46 (1.0)	45 (0.9)	48 (1.1)	47 (1.0)	42 (1.3)	44 (1.1)
[1] Lithuania	37 (0.9)	39 (0.9)	39 (1.1)	43 (1.1)	38 (1.1)	39 (1.3)	36 (1.1)	▲ 42 (1.4)
New Zealand	46 (1.0)	46 (0.9)	49 (1.1)	50 (1.0)	45 (1.3)	46 (1.2)	39 (1.0)	40 (1.0)
Norway	45 (0.8)	43 (0.8)	50 (1.0)	48 (1.0)	42 (0.9)	42 (1.1)	33 (0.8)	32 (1.1)
Portugal	37 (0.7)	36 (0.6)	39 (0.8)	39 (0.6)	40 (1.0)	36 (1.0)	31 (1.0)	31 (0.7)
Russian Federation	53 (1.2)	53 (0.8)	56 (1.3)	56 (0.8)	55 (1.4)	54 (1.2)	53 (1.5)	56 (0.9)
† Scotland	45 (1.1)	44 (0.9)	48 (1.2)	47 (1.1)	46 (1.3)	46 (1.1)	36 (1.1)	37 (0.9)
Singapore	73 (1.4)	73 (1.6)	79 (1.3)	79 (1.5)	68 (1.5)	69 (1.8)	68 (1.6)	68 (1.8)
Slovak Republic	55 (1.1)	54 (0.8)	59 (1.1)	58 (0.9)	58 (1.3)	55 (0.9)	49 (1.3)	52 (1.0)
Spain	43 (0.6)	42 (0.7)	43 (0.7)	42 (0.7)	44 (0.8)	42 (1.0)	41 (0.9)	41 (0.9)
Sweden	47 (0.7)	47 (0.8)	51 (0.8)	52 (1.0)	44 (0.8)	42 (1.0)	35 (0.7)	36 (0.8)
[1] Switzerland	54 (0.6)	52 (0.6)	61 (0.8)	58 (0.7)	48 (0.9)	44 (0.9)	41 (0.6)	41 (0.8)
† United States	48 (1.3)	48 (1.3)	54 (1.4)	54 (1.5)	44 (1.3)	43 (1.2)	42 (1.4)	45 (1.4)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):								
Australia	52 (1.2)	53 (1.0)	56 (1.3)	57 (1.1)	50 (1.1)	53 (1.1)	45 (1.3)	48 (1.1)
Austria	55 (1.1)	56 (0.8)	60 (1.2)	61 (0.9)	52 (1.4)	53 (1.2)	46 (1.2)	50 (0.9)
Netherlands	56 (1.3)	55 (1.1)	61 (1.5)	59 (1.2)	55 (1.5)	53 (1.2)	41 (1.3)	42 (1.1)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):								
Colombia	27 (0.8)	25 (1.0)	29 (1.0)	27 (0.9)	27 (1.2)	25 (1.3)	24 (1.0)	23 (1.4)
†[1] Germany	49 (1.3)	49 (1.1)	55 (1.4)	55 (1.3)	45 (1.4)	48 (1.3)	39 (1.6)	38 (1.4)
Romania	43 (0.9)	43 (0.9)	43 (1.0)	42 (0.9)	48 (1.1)	47 (1.1)	44 (1.2)	47 (1.2)
Slovenia	53 (0.8)	52 (0.8)	56 (0.9)	56 (0.8)	52 (1.1)	53 (0.9)	47 (1.1)	49 (0.9)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):								
Denmark	45 (0.7)	43 (0.7)	46 (0.9)	44 (0.9)	47 (1.0)	46 (1.1)	37 (0.9)	35 (0.9)
Greece	40 (0.7)	41 (0.6)	47 (0.8)	47 (0.8)	39 (0.8)	39 (0.9)	32 (0.9)	34 (0.7)
† South Africa	24 (1.4)	22 (0.8)	27 (1.5)	25 (1.0)	23 (1.4)	21 (0.8)	21 (1.3)	20 (0.7)
Thailand	51 (1.2)	52 (1.4)	56 (1.4)	56 (1.6)	57 (1.1)	58 (1.2)	44 (1.3)	46 (1.5)

▲ = Difference from other gender statistically significant at .05 level, adjusted for multiple comparisons

*Seventh grade in most countries; See Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 2.5 (Continued)

Average Percent Correct for Boys and Girls by Mathematics Content Areas Lower Grade (Seventh Grade*)

Country	Data Representation, Analysis & Probability		Measurement		Proportionality	
† Belgium (Fl)	73 (1.1)	73 (1.2)	60 (1.2)	59 (1.4)	53 (1.2)	55 (1.4)
† Belgium (Fr)	66 (1.3)	62 (1.4)	55 (1.1)	52 (1.4)	45 (1.4)	43 (1.1)
Canada	63 (0.9)	62 (0.8)	45 (0.7)	43 (0.8)	43 (0.9)	41 (0.8)
Cyprus	48 (0.9)	48 (0.7)	36 (0.9)	33 (0.8)	36 (1.1)	35 (0.8)
Czech Republic	63 (1.1)	60 (1.3)	57 (1.2)	52 (1.4)	42 (1.2)	40 (1.6)
†2 England	63 (1.3)	61 (1.4)	46 (1.5)	40 (1.1)	41 (1.6)	35 (1.2)
France	64 (1.0)	61 (0.9)	50 (1.1)	47 (1.1)	42 (1.1)	40 (1.2)
Hong Kong	69 (2.0)	67 (1.5)	63 (2.4)	60 (2.2)	56 (2.0)	54 (1.9)
Hungary	60 (1.0)	60 (1.0)	50 (1.1)	48 (1.2)	39 (1.1)	38 (1.2)
Iceland	56 (0.9)	55 (1.1)	38 (0.9)	38 (1.0)	▲ 35 (0.8)	31 (0.9)
Iran, Islamic Rep.	37 (0.9)	34 (1.0)	▲ 25 (1.1)	21 (0.9)	32 (1.3)	29 (0.7)
Ireland	65 (1.3)	62 (1.2)	49 (1.7)	43 (1.3)	48 (1.8)	45 (1.2)
Japan	73 (0.6)	72 (0.6)	63 (0.8)	60 (0.6)	▲ 57 (0.8)	53 (0.7)
Korea	▲ 75 (0.7)	70 (0.9)	64 (1.2)	60 (1.0)	56 (1.1)	53 (1.1)
1 Latvia (LSS)	49 (1.1)	49 (0.9)	43 (1.1)	39 (1.0)	34 (1.4)	31 (1.1)
1 Lithuania	43 (1.1)	44 (0.9)	33 (1.1)	32 (1.0)	25 (0.9)	24 (1.0)
New Zealand	58 (1.2)	59 (1.1)	42 (1.2)	39 (1.1)	38 (1.2)	37 (1.1)
Norway	60 (1.1)	57 (1.0)	45 (1.1)	42 (1.1)	35 (0.9)	33 (0.8)
Portugal	48 (0.9)	45 (0.8)	36 (0.8)	32 (0.9)	27 (0.8)	23 (0.8)
Russian Federation	56 (1.3)	53 (0.9)	48 (1.2)	47 (1.0)	40 (1.3)	39 (1.3)
† Scotland	58 (1.2)	57 (1.0)	42 (1.2)	39 (1.1)	36 (0.9)	33 (1.1)
Singapore	72 (1.5)	73 (1.5)	70 (1.7)	70 (1.9)	70 (1.6)	71 (1.6)
Slovak Republic	57 (0.9)	55 (0.8)	54 (1.2)	50 (1.0)	42 (1.2)	40 (1.1)
Spain	53 (0.8)	51 (0.9)	39 (0.9)	36 (0.9)	36 (0.8)	34 (0.8)
Sweden	64 (1.0)	64 (1.1)	48 (1.0)	45 (1.0)	36 (0.9)	35 (1.0)
1 Switzerland	67 (0.9)	64 (0.8)	54 (1.0)	51 (0.9)	46 (0.9)	43 (0.9)
† United States	60 (1.3)	60 (1.4)	37 (1.4)	35 (1.6)	39 (1.3)	37 (1.3)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	62 (1.2)	63 (1.0)	48 (1.3)	47 (1.1)	41 (1.3)	41 (1.0)
Austria	62 (1.1)	64 (1.0)	56 (1.1)	54 (0.9)	44 (1.2)	44 (1.2)
Netherlands	69 (1.3)	68 (1.2)	53 (1.4)	52 (1.3)	51 (1.5)	51 (1.7)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	33 (1.0)	32 (1.3)	23 (1.0)	21 (0.9)	21 (1.4)	20 (0.8)
†1 Germany	62 (1.3)	61 (1.2)	48 (1.1)	44 (1.0)	39 (1.4)	36 (1.1)
Romania	44 (0.9)	43 (0.9)	42 (1.3)	41 (1.0)	35 (1.1)	35 (1.0)
Slovenia	61 (0.8)	59 (0.9)	51 (0.9)	48 (1.1)	41 (1.2)	38 (1.0)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	61 (1.1)	57 (1.0)	42 (1.0)	40 (0.9)	▲ 37 (1.1)	31 (1.1)
Greece	46 (1.0)	46 (0.7)	36 (0.8)	34 (0.9)	34 (0.8)	34 (0.8)
† South Africa	26 (1.6)	24 (0.9)	19 (1.5)	16 (0.8)	21 (1.2)	20 (0.7)
Thailand	57 (1.2)	57 (1.2)	44 (1.3)	44 (1.7)	45 (1.3)	46 (1.6)

▲ = Difference from other gender statistically significant at .05 level, adjusted for multiple comparisons

*Seventh grade in most countries; See Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Chapter 3

PERFORMANCE ON ITEMS WITHIN EACH MATHEMATICS CONTENT AREA

This chapter presents five or six example items within each of the mathematics content areas, including the performance on each of the items for each of the TIMSS countries. The example items were selected to illustrate the different topics covered within each content area as well as the different performance expectations. The items also were chosen to show the range of item formats used within each area. To provide some sense of what types of items were answered correctly by higher-performing as compared to lower-performing students, the items show a range of difficulty within each content area. Finally, it should be noted that all these items and others are released for use by the public.[1]

The presentation for each of the content areas begins with a brief description of the major topics included in the content area and a discussion of student performance in that content area. The discussion is followed by a table showing the percent correct on the example items for each of the TIMSS countries at both the seventh and eighth grades. After the table showing the country-by-country results, there is a figure relating achievement on each of the example items to performance on the TIMSS international mathematics scale. This "difficulty map" provides a pictorial representation of achievement on the scale in relation to achievement on the items. Following the difficulty map, each item is presented in its entirety. The correct answer is circled for multiple-choice items and shown in the answer space for short-answer items. For extended-response questions, the answer shown exemplifies the type of student responses that were given full credit. All of the responses shown have been reproduced from students' actual test booklets.

WHAT HAVE STUDENTS LEARNED ABOUT FRACTIONS AND NUMBER SENSE?

The category of fractions and number sense included operations and problem solving with whole numbers, fractions, decimals, and percentages as well as estimating and rounding. Table 3.1 presents the percent of correct responses given by students in each of the TIMSS countries to each of the six example items presented within this category.

Figure 3.1 presents a pictorial representation of the relationship between performance on the TIMSS international mathematics scale and achievement on the six example items for fractions and number sense.[2] The international achievement on each example item is indicated both by the average percent correct across all countries at the seventh and eighth grades and by the international mathematics scale value, or

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[1] The IEA retained about one-third of the TIMSS items as secure for possible future use in measuring international trends in mathematics and science achievement. All remaining items are available for general use.

[2] The three-digit item label shown in the lower right corner of the box locating each example item on the item difficulty map refers to the original item identification number used in the student test booklets.

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Table 3.1

Percent Correct for Fractions and Number Sense Example Items - Lower and Upper Grades (Seventh and Eighth Grades*)

Country	Example 1 Subtraction problem with whole numbers.		Example 2 Write a larger fraction.		Example 3 Distance on map.	
	Seventh Grade	Eighth Grade	Seventh Grade	Eighth Grade	Seventh Grade	Eighth Grade
[†] Belgium (Fl)	96 (1.1)	93 (2.9)	82 (2.6)	81 (3.1)	84 (1.8)	84 (2.6)
[†] Belgium (Fr)	95 (1.4)	91 (1.6)	70 (2.9)	72 (2.6)	76 (2.7)	82 (3.1)
Canada	91 (1.6)	91 (1.7)	74 (2.4)	80 (1.6)	62 (2.9)	63 (2.0)
Cyprus	81 (1.9)	85 (2.2)	80 (2.4)	77 (2.4)	49 (2.9)	61 (2.7)
Czech Republic	97 (1.1)	97 (0.9)	81 (2.2)	83 (2.1)	76 (2.3)	83 (2.5)
[†][2] England	59 (3.2)	65 (3.2)	79 (3.1)	79 (2.6)	61 (3.4)	69 (3.1)
France	92 (1.5)	97 (1.2)	66 (1.8)	75 (2.4)	72 (2.6)	84 (2.0)
Hong Kong	90 (1.4)	89 (1.9)	86 (2.2)	85 (2.2)	59 (2.4)	64 (2.5)
Hungary	95 (1.3)	96 (1.2)	85 (2.0)	87 (1.9)	73 (2.4)	82 (2.0)
Iceland	91 (2.0)	89 (3.2)	82 (3.4)	89 (2.8)	69 (3.2)	68 (4.4)
Iran, Islamic Rep.	86 (2.4)	83 (2.6)	38 (4.0)	31 (3.2)	30 (3.0)	32 (3.2)
Ireland	93 (1.5)	94 (1.5)	83 (1.9)	82 (2.0)	58 (2.9)	67 (2.4)
Japan	89 (1.4)	93 (1.2)	85 (1.3)	87 (1.2)	76 (1.7)	79 (1.7)
Korea	91 (1.6)	89 (1.8)	77 (2.3)	84 (2.2)	65 (2.1)	74 (2.3)
[1] Latvia (LSS)	84 (2.3)	89 (2.1)	60 (2.6)	69 (3.1)	61 (2.8)	70 (2.8)
[1] Lithuania	88 (2.3)	92 (1.6)	61 (3.8)	67 (3.0)	50 (3.5)	67 (3.0)
New Zealand	69 (3.5)	71 (2.3)	81 (2.4)	80 (2.0)	64 (2.6)	67 (2.2)
Norway	85 (5.5)	87 (2.0)	73 (5.3)	84 (1.6)	68 (3.8)	65 (2.7)
Portugal	78 (2.4)	87 (1.7)	62 (2.4)	63 (2.7)	48 (2.8)	56 (2.6)
Russian Federation	92 (1.6)	92 (1.6)	78 (1.9)	83 (1.9)	66 (2.2)	77 (2.3)
[†] Scotland	75 (2.5)	72 (2.5)	76 (2.4)	81 (2.4)	55 (2.8)	65 (3.1)
Singapore	98 (0.6)	98 (0.7)	84 (2.1)	88 (1.6)	79 (2.4)	84 (1.6)
Slovak Republic	94 (1.0)	93 (1.3)	80 (1.9)	85 (1.8)	70 (2.3)	76 (2.3)
Spain	94 (1.5)	98 (0.7)	71 (2.2)	71 (2.0)	53 (2.7)	62 (2.3)
Sweden	84 (2.2)	88 (1.6)	74 (2.6)	78 (2.5)	76 (2.2)	77 (1.9)
[1] Switzerland	96 (0.9)	96 (1.1)	81 (2.0)	83 (2.0)	76 (2.5)	81 (2.5)
[†] United States	88 (2.1)	90 (1.1)	79 (2.2)	81 (1.9)	52 (3.4)	61 (2.5)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	82 (2.4)	82 (1.7)	76 (2.3)	78 (1.6)	68 (2.7)	69 (1.8)
Austria	94 (1.3)	96 (1.2)	89 (2.0)	87 (1.7)	76 (2.5)	78 (3.6)
Bulgaria	84 (3.3)	78 (2.8)	65 (4.7)	64 (4.7)	66 (5.0)	75 (4.4)
Netherlands	88 (2.6)	82 (3.6)	86 (2.5)	76 (3.3)	71 (2.7)	74 (3.7)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	57 (3.5)	64 (4.0)	66 (3.5)	77 (2.8)	34 (3.1)	31 (3.1)
[†][1] Germany	93 (1.4)	89 (2.0)	80 (2.2)	81 (2.3)	68 (2.9)	72 (2.9)
Romania	80 (2.0)	79 (2.4)	61 (2.9)	64 (2.7)	50 (2.9)	50 (2.7)
Slovenia	95 (1.2)	98 (0.8)	77 (2.7)	77 (2.7)	71 (2.4)	76 (2.2)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	86 (2.5)	88 (2.0)	64 (3.2)	65 (3.8)	73 (2.9)	85 (2.3)
Greece	87 (1.5)	91 (1.4)	82 (1.6)	77 (2.0)	42 (2.6)	50 (2.4)
[†] South Africa	57 (2.7)	56 (3.3)	45 (3.7)	50 (2.4)	23 (2.2)	24 (2.2)
Thailand	87 (1.6)	86 (1.6)	68 (2.3)	73 (2.1)	66 (2.4)	67 (2.2)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):						
[1] Israel	–	95 (1.4)	–	80 (3.1)	–	59 (3.3)
Kuwait	–	52 (3.5)	–	37 (5.7)	–	30 (4.6)

*Seventh and eighth grades in most countries; See Table 2 for information about the grades tested in each country.

[†] Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. Israel and Kuwait did not test at the seventh grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 3.1 (Continued)

Percent Correct for Fractions and Number Sense Example Items - Lower and Upper Grades (Seventh and Eighth Grades*)

Country	Example 4 Actual weight from rounded value.		Example 5 Rate of fuel consumption		Example 6 Percent increase in price.	
	Seventh Grade	**Eighth Grade**	**Seventh Grade**	**Eighth Grade**	**Seventh Grade**	**Eighth Grade**
† Belgium (Fl)	65 (2.7)	65 (2.4)	37 (2.9)	49 (3.0)	37 (2.9)	33 (2.4)
† Belgium (Fr)	23 (2.1)	30 (2.6)	36 (2.8)	36 (2.6)	29 (3.1)	36 (4.4)
Canada	60 (1.8)	67 (1.7)	32 (2.0)	36 (2.0)	16 (1.3)	20 (1.7)
Cyprus	12 (1.2)	17 (1.9)	29 (2.8)	30 (2.5)	19 (2.4)	19 (2.8)
Czech Republic	69 (2.3)	80 (1.7)	43 (3.3)	43 (4.1)	29 (2.9)	38 (3.4)
†[2] England	62 (2.5)	72 (2.5)	30 (2.7)	40 (2.9)	18 (2.4)	21 (2.5)
France	–	–	27 (2.4)	34 (2.5)	17 (2.3)	29 (2.7)
Hong Kong	47 (3.4)	56 (2.8)	44 (2.8)	48 (3.1)	47 (2.9)	54 (2.7)
Hungary	60 (2.0)	67 (2.0)	40 (2.3)	46 (3.0)	36 (2.3)	46 (2.8)
Iceland	51 (2.6)	59 (4.1)	39 (4.0)	25 (4.1)	9 (1.9)	24 (3.2)
Iran, Islamic Rep.	5 (1.6)	6 (1.1)	33 (2.5)	30 (2.3)	15 (2.9)	11 (2.2)
Ireland	65 (2.1)	68 (2.0)	44 (2.9)	42 (2.5)	35 (2.5)	39 (3.2)
Japan	67 (1.3)	76 (1.3)	–	–	34 (2.0)	41 (2.0)
Korea	80 (1.6)	85 (1.3)	41 (2.9)	50 (2.7)	36 (3.1)	37 (2.8)
[1] Latvia (LSS)	38 (2.0)	49 (2.5)	36 (3.0)	38 (3.3)	14 (2.4)	17 (2.4)
[1] Lithuania	37 (2.5)	47 (2.5)	36 (2.9)	38 (3.3)	12 (2.0)	14 (2.5)
New Zealand	65 (2.0)	74 (1.8)	36 (2.7)	40 (2.7)	21 (2.3)	30 (2.4)
Norway	64 (2.4)	77 (1.6)	37 (3.6)	37 (2.7)	16 (2.6)	29 (2.5)
Portugal	29 (1.9)	33 (1.9)	32 (2.3)	37 (2.6)	10 (1.4)	11 (1.6)
Russian Federation	54 (2.0)	59 (2.8)	42 (2.5)	41 (2.9)	16 (1.8)	26 (2.4)
† Scotland	62 (2.6)	74 (2.0)	32 (2.5)	38 (2.9)	19 (2.2)	25 (3.2)
Singapore	82 (2.2)	89 (1.3)	62 (3.1)	70 (2.6)	69 (3.0)	78 (2.4)
Slovak Republic	41 (2.0)	52 (2.1)	33 (2.3)	38 (2.4)	20 (2.3)	34 (2.6)
Spain	17 (1.4)	28 (2.1)	30 (2.5)	25 (2.2)	11 (1.6)	11 (1.6)
Sweden	80 (1.7)	88 (1.3)	34 (2.8)	43 (2.8)	19 (2.3)	32 (2.1)
[1] Switzerland	49 (2.0)	59 (1.8)	34 (2.1)	44 (2.1)	16 (2.1)	25 (1.8)
† United States	57 (2.1)	66 (2.1)	32 (2.1)	34 (1.8)	14 (2.1)	20 (1.8)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	73 (1.7)	81 (1.4)	34 (2.5)	42 (2.2)	21 (2.0)	28 (1.9)
Austria	57 (2.4)	63 (2.1)	31 (2.3)	33 (2.7)	32 (2.9)	40 (2.7)
Bulgaria	32 (3.3)	44 (3.8)	41 (5.2)	63 (5.2)	24 (3.3)	29 (4.6)
Netherlands	51 (2.1)	61 (2.9)	32 (3.1)	50 (3.5)	33 (3.7)	44 (3.1)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	6 (0.9)	6 (1.1)	33 (4.5)	29 (3.4)	11 (2.1)	11 (2.0)
†[1] Germany	48 (2.5)	55 (2.4)	37 (3.1)	37 (2.7)	27 (2.8)	32 (3.5)
Romania	25 (1.9)	26 (2.0)	33 (2.4)	39 (2.9)	13 (1.9)	20 (2.2)
Slovenia	27 (1.8)	38 (2.4)	32 (2.4)	31 (2.9)	21 (2.4)	31 (2.6)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	59 (2.7)	71 (2.0)	30 (2.7)	31 (3.5)	17 (3.2)	22 (2.3)
Greece	49 (2.0)	56 (2.0)	29 (2.1)	29 (2.6)	20 (2.0)	19 (2.0)
† South Africa	20 (2.0)	16 (2.2)	24 (2.1)	23 (2.1)	24 (1.7)	18 (1.7)
Thailand	40 (2.4)	40 (2.4)	38 (2.8)	44 (2.7)	26 (2.3)	33 (3.2)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):						
[1] Israel	–	63 (3.6)	–	41 (5.1)	–	31 (4.5)
Kuwait	–	10 (1.6)	–	22 (2.3)	–	13 (2.6)

*Seventh and eighth grades in most countries: See Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

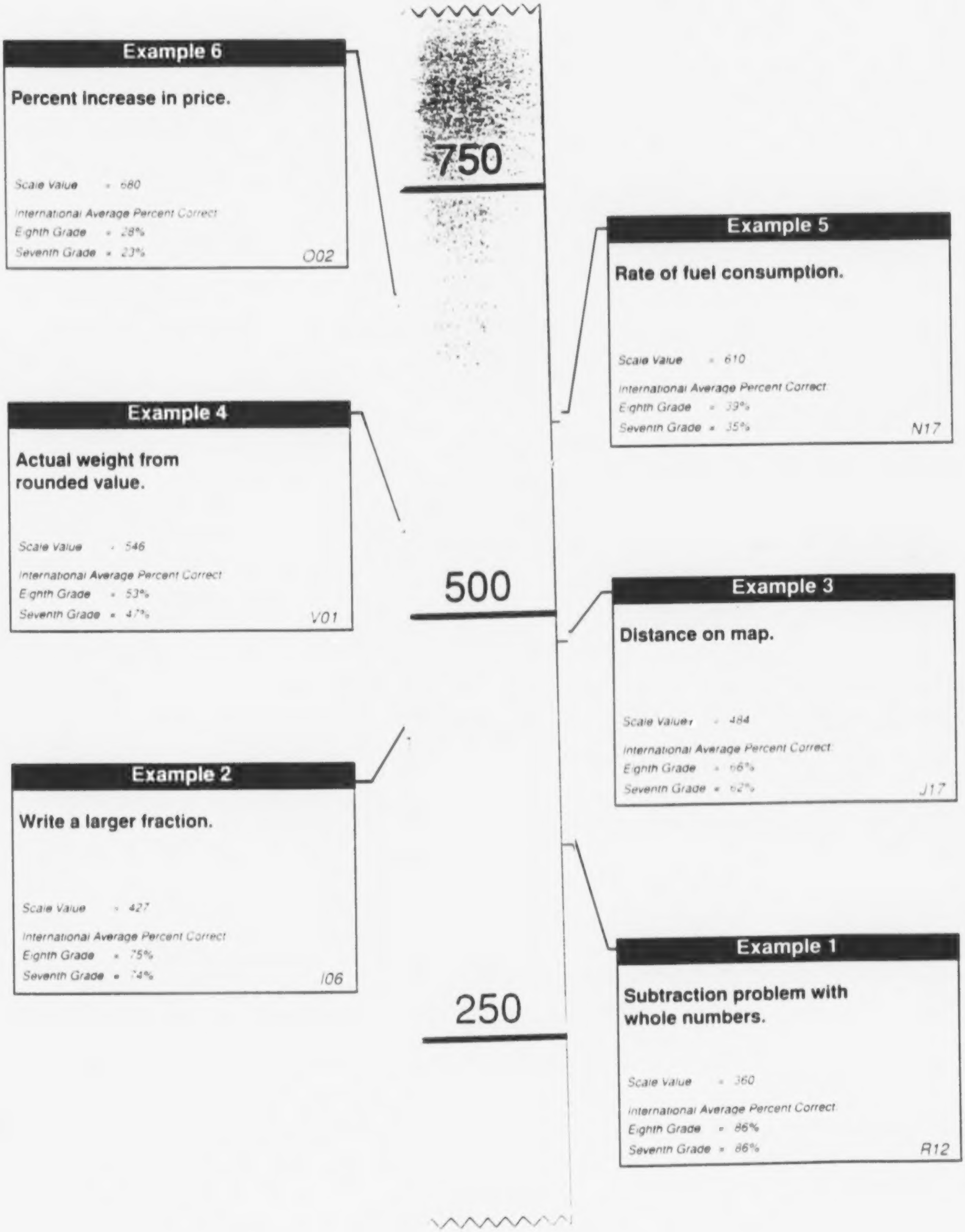
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. Israel and Kuwait did not test at the seventh grade. Internationally comparable data are unavailable for France on Example 4 and Japan on Example 5.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 3.1

International Difficulty Map for Fractions and Number Sense Example Items Lower and Upper Grades (Seventh and Eighth Grades*)



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*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

NOTE: Each item was placed onto the TIMSS international mathematics scale based on students' performance in both grades. Items are shown at the point on the scale where students with that level of proficiency had a 65 percent probability of providing a correct response.

item difficulty level, for each item. Since the scale was developed based on the performance of students at both grades in all countries, the international scale values apply to both grades and to all countries.

For the figure, the item results have been placed on the scale at the point where students at that level were more likely than not (65% probability) to answer the question correctly. For example, students scoring at or above 546 on the scale were likely to provide a correct response to the rounding item about the dolphin's actual weight (Example Item 4), and those scoring at or above 610 were likely to have responded correctly to the problem about rate of fuel consumption (Example Item 5). Considering that the international average on the scale was 513 at the eighth grade, however, students achieving at about the level of the international average were unlikely to have answered Example Item 5 (or Example Item 6 about percent increases) correctly. These results, however, varied dramatically by country. Eighth-grade students in Singapore, whose mean achievement was 643, had relatively high probabilities of answering all but the most difficult fractions and number sense items correctly. Indeed, this is borne out by Singapore's average percent correct of 79% in this content area at the eighth grade.

The six example items are presented in their entirety beginning on the next page. Example Item 1 is a subtraction problem with whole numbers that requires regrouping (borrowing). The international averages for the percent correct (86% for both grades) indicate that most seventh and eighth graders were successful on this item. In general, the lack of variation in performance between grades and across countries suggest that students in most countries have developed a grasp of how to solve this type of problem prior to the seventh and eighth grades.

Example Item 2 about understanding the relative size of fractions required students to provide their response, rather than select an answer in the multiple-choice format. On average, approximately three-fourths of both the seventh and eighth graders (74% and 75%, respectively) provided a correct response (any fraction larger than two-sevenths). Again, there were few differences in performance across countries or grade levels. With the exception of Iran, Kuwait, and South Africa, at least 60% of the seventh and eighth graders in each of the participating countries responded correctly.

Internationally, on average, about two-thirds of the students at seventh and eighth grades (62% and 66%) correctly interpreted the information about scale provided on the map shown in Example Item 3. As might be expected, the eighth graders performed better than seventh graders in many countries. Notwithstanding the between-grade increases, in all but a few cases, the majority of seventh graders answered the question correctly.

Averaged across countries, Example Item 4, which required students to demonstrate their understanding of rounded values, was answered correctly by approximately half the students at seventh and eighth grades (47% and 53%). Any value within the range of 165 through 174 was coded as a correct response. On this item, however, there was considerable variation in performance across countries. For example, 80% or more of the students at one or both grades in the Czech Republic, Korea, Singapore, Sweden, and Australia provided a correct answer to this question. In contrast, fewer than 20% of the students did so at one or both grades in Cyprus, Iran, Spain, Colombia, Kuwait, and South Africa.

Multi-step problems such as the one shown in Example Item 5 were difficult for students around the world. On average, 35% of the seventh-grade students and 39% of those in eighth grade responded correctly. The most prevalent mistake was to select the amount of fuel used on the trip (option C) rather than the amount of fuel remaining in the tank.

The international averages for Example Item 6 indicate that working with percentages is a challenge for students in most countries. Only about one-fourth of the students at seventh and eighth grades (23% and 28%) responded correctly to this multiple-choice item. Singapore posted by far the best performance on this item (69% and 78% correct at grades 7 and 8), with Hong Kong having the next highest achievement (47% and 54% correct).

EXAMPLE ITEM 1
FRACTIONS & NUMBER SENSE

Subtraction problem with whole numbers

Subtract: 6000
−2369

A. 4369

B. 3742

[✓ C.] 3631

D. 3531

Performance Category: Performing Routine Procedures

EXAMPLE ITEM 2
FRACTIONS & NUMBER SENSE

Write a larger fraction

Write a fraction that is larger than $\frac{2}{7}$.

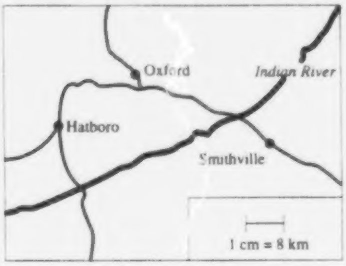
Answer: $\frac{3}{7}$

Performance Category: Knowing

EXAMPLE ITEM 3
FRACTIONS & NUMBER SENSE

Distance on map

One centimeter on the map represents 8 kilometers on the land.



About how far apart are Oxford and Smithville on the land?

A. 4 km

B. 16 km

[✓ C.] 35 km

D. 50 km

Performance Category: Using Complex Procedures

EXAMPLE ITEM 4
FRACTIONS & NUMBER SENSE

Actual weight from rounded value

Rounded to the nearest 10 kg the weight of a dolphin was reported as 170 kg. Write down a weight that might have been the actual weight of the dolphin.

Answer: 168

Performance Category: Using Complex Procedures

Example Item 5
Fractions & Number Sense

Rate of fuel consumption

A car has a fuel tank that holds 35 L of fuel. The car consumes 7.5 L of fuel for each 100 km driven. A trip of 250 km was started with a full tank of fuel. How much fuel remained in the tank at the end of the trip?

[✓ A.] 16.25 L

B. 17.65 L

C. 18.75 L

D. 23.75 L

Performance Category: Solving Problems

Example Item 6
Fractions & Number Sense

Percent increase in price

If the price of a can of beans is raised from 60 cents to 75 cents, what is the percent increase in the price?

A. 15%

B. 20%

[✓ C.] 25%

D. 30%

Performance Category: Performing Routine Procedures

WHAT HAVE STUDENTS LEARNED ABOUT GEOMETRY?

There was perhaps more variation in the geometry curriculum across countries than in any of the other mathematics content areas. The TIMSS geometry items required students to visualize geometric figures and to demonstrate their understanding of the properties of geometric figures. The concepts measured included symmetry, congruence, and similarity. Table 3.2 presents the results for the example items in geometry. Figure 3.2 presents the international difficulty map for the example items in geometry. Considering the international mean on the mathematics scale of 513 (for eighth grade), it can be seen that students performing above the mean were much more likely to understand the properties of geometric figures.

The range of student understanding in geometry is demonstrated by their performance on Example Items 7 through 12. Example Item 7 assessed spatial visualization skills, and Example Item 8 lines of symmetry. Although the content differed, internationally about two-thirds of the seventh- and eighth-grade students answered these questions correctly (Example Item 7 - 63% and 67%, Example Item 8 - 63% and 66%). Some countries did much better on these items than others. At the eighth grade, 80% or more students answered Example Item 7 correctly in Belgium (Flemish), the Czech Republic, Iceland, Japan, Latvia (LSS), the Slovak Republic, Switzerland, and Austria. This compares to fewer than half answering correctly in Cyprus, Iran, Colombia, South Africa, and Kuwait. Similarly, a number of countries were at about the 80% level on Example Item 8, while a few were at or below the level of 50% correct responses.

On average, Example Item 9, requiring understanding of ratio and perimeter, was answered correctly by 50% of the students at seventh grade and 56% at the eighth grade. In general, these international results reflect increases in achievement between the two grades shown in many countries and seem consistent with a curricular emphasis in geometry during the eighth grade.

The majority of students in many countries had difficulties with Example Item 10 on the properties of parallelograms. The international averages for the percents correct were 44% and 49% at the seventh and eighth grades, respectively. Only in Flemish-speaking Belgium (79%), Korea, (79%), and Bulgaria (78%) did more than three-fourths of the eighth-grade students answer this question correctly.

When given its coordinates and asked about another point on a line (Example Item 11), students showed great variation in performance from country to country. On average, the results were low at both seventh and eighth grades (38% and 41%). In the Netherlands, the top-performing country on this item, the corresponding figures were 62% and 66%. Students in England (58% and 55%) and Scotland (54% and 52%) also performed relatively well compared to their counterparts in other countries.

One of the most difficult geometry items assessed understanding of the properties of congruent triangles (Example Item 12). Internationally, the average percent of correct responses was 27% for the seventh grade and 35% for the eighth grade. Still, about two-thirds of the eighth-grade students responded correctly in Japan, Korea, and Singapore.

Table 3.2

Percent Correct for Geometry Example Items Lower and Upper Grades (Seventh and Eighth Grades*)

Country	Example 7 Rotated 3-dimensional figure		Example 8 Lines of symmetry		Example 9 Ratio of side length to perimeter	
	Seventh Grade	Eighth Grade	Seventh Grade	Eighth Grade	Seventh Grade	Eighth Grade
[†] **Belgium (Fl)**	83 (1.8)	83 (2.1)	78 (2.2)	78 (3.3)	71 (2.7)	72 (3.5)
[†] **Belgium (Fr)**	76 (2.5)	74 (2.4)	71 (3.0)	80 (2.4)	66 (3.1)	62 (3.1)
Canada	68 (2.2)	75 (2.1)	78 (1.9)	76 (2.1)	51 (2.5)	69 (1.8)
Cyprus	49 (3.1)	43 (3.0)	56 (2.7)	58 (2.2)	35 (2.7)	55 (2.7)
Czech Republic	78 (1.9)	87 (1.9)	69 (2.8)	74 (2.6)	53 (2.6)	60 (2.9)
[†2] England	72 (3.0)	77 (2.9)	79 (2.7)	82 (2.6)	49 (3.4)	52 (3.3)
France	71 (2.4)	77 (2.1)	79 (2.1)	80 (2.3)	58 (3.3)	69 (2.5)
Hong Kong	72 (3.0)	75 (2.7)	78 (2.6)	73 (2.4)	63 (3.6)	71 (2.6)
Hungary	61 (2.6)	71 (2.6)	80 (2.2)	82 (2.1)	43 (3.1)	55 (2.7)
Iceland	71 (3.1)	81 (2.2)	76 (2.4)	55 (3.5)	28 (2.7)	32 (3.1)
Iran, Islamic Rep.	52 (3.9)	42 (2.6)	68 (3.3)	68 (3.3)	57 (3.9)	50 (3.6)
Ireland	69 (2.2)	75 (2.5)	59 (2.6)	64 (2.6)	47 (2.6)	54 (3.2)
Japan	74 (1.9)	80 (1.3)	82 (1.6)	77 (1.6)	76 (1.8)	80 (1.6)
Korea	62 (2.5)	74 (2.6)	49 (3.0)	58 (2.7)	77 (2.0)	78 (2.1)
[1] Latvia (LSS)	85 (1.9)	81 (2.6)	45 (3.4)	50 (3.1)	40 (3.5)	54 (3.2)
[1] Lithuania	60 (3.0)	69 (3.1)	49 (3.2)	58 (3.6)	33 (2.8)	46 (3.0)
New Zealand	65 (2.9)	67 (2.3)	70 (2.7)	80 (2.0)	40 (2.6)	48 (2.5)
Norway	73 (2.9)	78 (2.1)	47 (3.1)	42 (2.7)	33 (3.0)	41 (2.5)
Portugal	51 (2.8)	58 (2.5)	46 (2.3)	44 (2.7)	45 (2.8)	48 (2.3)
Russian Federation	69 (2.4)	75 (2.8)	61 (2.4)	67 (3.3)	49 (3.1)	55 (4.3)
[†] Scotland	65 (2.6)	72 (2.3)	83 (2.3)	86 (1.7)	47 (2.8)	48 (3.0)
Singapore	77 (1.9)	79 (1.9)	77 (3.0)	81 (2.1)	75 (2.5)	80 (1.8)
Slovak Republic	71 (2.3)	81 (2.1)	70 (2.7)	75 (2.2)	59 (2.3)	67 (2.3)
Spain	68 (2.4)	71 (2.2)	47 (2.6)	51 (2.5)	48 (2.7)	55 (2.6)
Sweden	49 (3.0)	53 (2.6)	51 (2.7)	44 (2.4)	40 (2.8)	47 (2.5)
[1] Switzerland	79 (2.3)	82 (2.0)	58 (2.8)	76 (2.6)	44 (2.6)	55 (2.4)
[†] United States	63 (2.3)	62 (2.5)	66 (3.0)	70 (2.2)	45 (3.0)	55 (1.9)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	69 (2.5)	73 (1.7)	70 (1.8)	69 (2.0)	54 (3.0)	60 (2.1)
Austria	70 (2.6)	80 (2.8)	53 (2.6)	57 (3.9)	54 (3.5)	69 (3.0)
Bulgaria	48 (3.5)	58 (5.3)	66 (4.3)	78 (4.7)	61 (5.2)	56 (3.4)
Netherlands	64 (3.3)	77 (2.7)	85 (2.4)	72 (3.9)	54 (2.7)	60 (4.5)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	46 (3.8)	41 (3.6)	40 (3.6)	44 (3.9)	30 (4.3)	37 (4.2)
[†1] Germany	72 (2.2)	72 (2.7)	58 (3.1)	64 (3.1)	36 (3.2)	45 (3.3)
Romania	50 (2.8)	53 (2.4)	49 (2.5)	46 (2.7)	52 (2.9)	59 (2.8)
Slovenia	72 (2.3)	73 (2.5)	51 (2.8)	69 (2.5)	53 (2.4)	69 (2.7)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	68 (3.4)	73 (3.1)	51 (3.2)	52 (3.2)	31 (3.5)	35 (3.1)
Greece	55 (2.1)	64 (2.7)	50 (2.4)	62 (3.0)	49 (2.3)	61 (2.2)
[†] South Africa	30 (2.2)	36 (2.3)	31 (2.6)	29 (2.3)	36 (2.3)	31 (2.5)
Thailand	42 (2.2)	50 (2.5)	79 (1.8)	80 (1.8)	56 (2.9)	64 (2.2)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):						
[1] Israel	–	57 (3.5)	–	76 (3.5)	–	69 (3.5)
Kuwait	–	29 (3.1)	–	61 (4.2)	–	38 (4.8)

*Seventh and eighth grades in most countries; See Table 2 for information about the grades tested in each country.

[†] Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. Israel and Kuwait did not test at the seventh grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Table 3.2 (Continued)

Percent Correct for Geometry Example Items Lower and Upper Grades (Seventh and Eighth Grades*)

Country	Example 10 Properties of parallelograms.		Example 11 Point on a line.		Example 12 Congruent triangles.	
	Seventh Grade	Eighth Grade	Seventh Grade	Eighth Grade	Seventh Grade	Eighth Grade
† **Belgium (Fl)**	78 (2.5)	79 (2.0)	39 (2.4)	44 (3.5)	29 (2.8)	43 (2.8)
† **Belgium (Fr)**	50 (3.2)	57 (2.5)	24 (3.0)	23 (2.6)	29 (3.0)	32 (2.8)
Canada	48 (2.8)	48 (2.5)	43 (2.1)	49 (2.0)	20 (2.3)	29 (2.5)
Cyprus	37 (2.7)	41 (3.0)	29 (2.6)	30 (2.5)	33 (2.6)	41 (2.4)
Czech Republic	47 (3.0)	57 (3.0)	30 (2.9)	34 (3.1)	43 (3.7)	51 (3.0)
†[2] England	39 (3.3)	48 (3.4)	58 (3.6)	55 (3.7)	24 (2.8)	31 (3.7)
France	48 (2.8)	62 (3.0)	24 (2.2)	34 (2.5)	38 (3.2)	50 (2.8)
Hong Kong	58 (3.4)	56 (2.5)	51 (2.5)	50 (2.8)	55 (3.0)	61 (2.7)
Hungary	42 (2.7)	57 (2.6)	47 (3.2)	51 (2.6)	28 (2.4)	39 (2.8)
Iceland	41 (4.7)	43 (3.3)	39 (4.2)	43 (3.4)	24 (3.2)	43 (3.6)
Iran, Islamic Rep.	30 (3.3)	31 (2.4)	22 (3.0)	17 (2.4)	28 (3.8)	35 (2.8)
Ireland	44 (2.5)	47 (2.9)	45 (2.7)	46 (2.6)	26 (2.2)	34 (2.6)
Japan	–	–	39 (2.1)	47 (2.2)	40 (2.1)	69 (1.7)
Korea	59 (2.3)	79 (2.1)	42 (3.0)	42 (3.2)	55 (2.8)	66 (2.1)
[1] Latvia (LSS)	27 (2.8)	51 (3.1)	34 (3.1)	38 (3.0)	20 (2.3)	25 (2.9)
[1] Lithuania	30 (3.5)	47 (3.2)	21 (3.0)	24 (2.8)	10 (2.0)	27 (2.8)
New Zealand	42 (2.7)	44 (2.8)	45 (3.1)	52 (2.8)	19 (2.0)	26 (2.5)
Norway	37 (3.6)	45 (2.6)	29 (3.2)	44 (3.1)	25 (2.5)	30 (2.3)
Portugal	33 (2.7)	33 (2.2)	35 (2.7)	46 (2.5)	21 (2.0)	21 (2.3)
Russian Federation	42 (2.4)	69 (3.3)	35 (3.3)	46 (3.3)	33 (3.2)	39 (2.9)
† Scotland	40 (3.1)	42 (2.5)	54 (2.7)	52 (3.1)	25 (2.2)	29 (2.7)
Singapore	58 (2.9)	57 (2.3)	47 (2.6)	59 (2.3)	55 (2.8)	69 (2.3)
Slovak Republic	43 (2.6)	46 (3.3)	33 (2.5)	40 (2.8)	35 (2.0)	45 (2.5)
Spain	39 (2.6)	40 (2.5)	37 (2.9)	39 (2.6)	17 (2.0)	14 (1.9)
Sweden	40 (2.7)	44 (2.6)	38 (2.5)	51 (2.3)	18 (2.3)	34 (2.4)
[1] Switzerland	39 (3.1)	52 (2.9)	46 (2.8)	51 (2.7)	25 (2.1)	33 (2.8)
† United States	39 (2.8)	40 (2.2)	37 (2.8)	41 (1.8)	15 (1.8)	17 (1.6)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	44 (2.5)	46 (2.1)	47 (2.4)	51 (1.8)	29 (2.2)	34 (1.8)
Austria	49 (3.2)	48 (3.5)	46 (2.8)	54 (3.3)	32 (3.0)	29 (2.9)
Bulgaria	72 (4.0)	78 (4.5)	38 (4.5)	38 (5.1)	45 (5.4)	44 (5.1)
Netherlands	27 (2.9)	37 (3.8)	62 (3.4)	66 (4.5)	14 (2.4)	21 (3.0)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	32 (2.9)	34 (3.9)	24 (4.6)	28 (4.3)	8 (1.5)	12 (2.6)
†[1] Germany	42 (3.1)	55 (3.2)	32 (2.9)	38 (2.9)	28 (2.7)	29 (3.0)
Romania	60 (2.9)	67 (2.9)	18 (2.0)	22 (2.3)	34 (2.5)	41 (2.9)
Slovenia	34 (2.9)	40 (2.9)	37 (2.8)	32 (2.9)	26 (2.7)	37 (3.3)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	41 (3.4)	43 (3.0)	45 (3.0)	51 (3.7)	19 (2.7)	33 (3.2)
Greece	48 (2.7)	47 (2.7)	32 (2.2)	25 (2.4)	19 (2.2)	37 (2.3)
† South Africa	27 (2.2)	27 (2.0)	28 (2.2)	25 (2.2)	11 (1.3)	14 (1.8)
Thailand	62 (1.8)	62 (2.4)	47 (2.3)	44 (2.7)	22 (1.8)	33 (2.2)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):						
[1] Israel	–	57 (3.1)	–	42 (3.6)	–	43 (3.4)
Kuwait	–	13 (2.4)	–	24 (3.0)	–	20 (3.2)

*Seventh and eighth grades in most countries; See Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

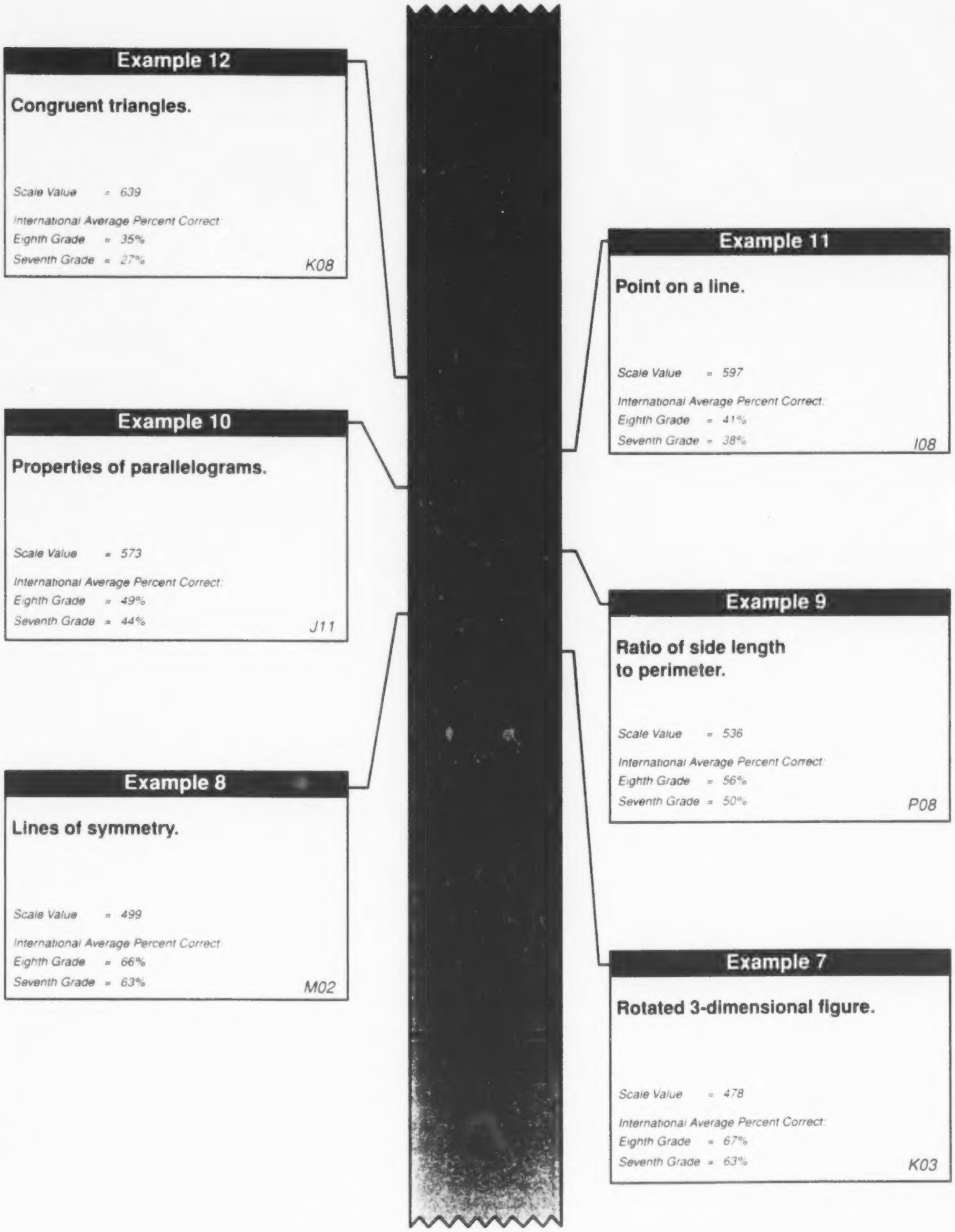
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. Israel and Kuwait did not test at the seventh grade. Internationally comparable data are unavailable for Japan on Example 10.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 3.2

International Difficulty Map for Geometry Example Items Lower and Upper Grades (Seventh and Eighth Grades*)



Example 12

Congruent triangles.

Scale Value = 639

International Average Percent Correct:
Eighth Grade = 35%
Seventh Grade = 27%
K08

Example 11

Point on a line.

Scale Value = 597

International Average Percent Correct:
Eighth Grade = 41%
Seventh Grade = 38%
I08

Example 10

Properties of parallelograms.

Scale Value = 573

International Average Percent Correct:
Eighth Grade = 49%
Seventh Grade = 44%
J11

Example 9

Ratio of side length to perimeter.

Scale Value = 536

International Average Percent Correct:
Eighth Grade = 56%
Seventh Grade = 50%
P08

Example 8

Lines of symmetry.

Scale Value = 499

International Average Percent Correct:
Eighth Grade = 66%
Seventh Grade = 63%
M02

Example 7

Rotated 3-dimensional figure.

Scale Value = 478

International Average Percent Correct:
Eighth Grade = 67%
Seventh Grade = 63%
K03

---

*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

NOTE: Each item was placed onto the TIMSS international mathematics scale based on students' performance in both grades. Items are shown at the point on the scale where students with that level of proficiency had a 65 percent probability of providing a correct response.

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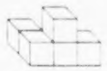
EXAMPLE ITEM 7
GEOMETRY

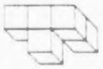
Rotated 3-dimensional figure

This figure will be turned to a different position.

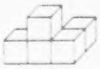


Which of these could be the figure after it is turned?

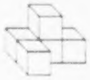
[✓ A.]



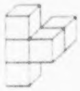
B.



C.



D.



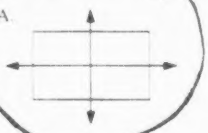
Performance Category: Using Complex Procedures

EXAMPLE ITEM 8
GEOMETRY

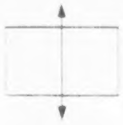
Lines of symmetry

Which shows all of the lines of symmetry for a rectangle?

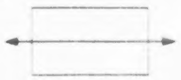
[✓ A.]



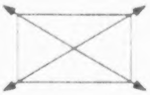
B.



C.



D.



Performance Category: Knowing

Example Item 9
Geometry

Ratio of side length to perimeter

What is the ratio of the length of a side of a square to its perimeter?

A. $\frac{1}{1}$

B. $\frac{1}{2}$

C. $\frac{1}{3}$

[✓ D.] $\frac{1}{4}$

Performance Category: Solving Problems

Example Item 10
Geometry

Properties of parallelograms

A quadrilateral MUST be a parallelogram if it has

A. one pair of adjacent sides equal

B. one pair of parallel sides

C. a diagonal as axis of symmetry

D. two adjacent angles equal

[✓ E.] two pairs of parallel sides

Performance Category: Knowing

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Example Item 11
Geometry

Point on a line

A straight line on a graph passes through the points (3,2) and (4,4). Which of these points also lies on the line?

A. (1,1)

B. (2,4)

[✓ C.] (5,6)

D. (6,3)

E. (6,5)

Performance Category: Solving Problems

Example Item 12
Geometry

Congruent triangles

These triangles are congruent. The measures of some of the sides and angles of the triangles are shown.

What is the value of x ?

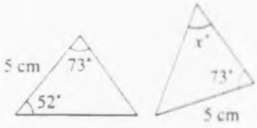
A. 52

[✓ B. 55]

C. 65

D. 73

E. 75



Performance Category: Performing Routine Procedures

WHAT HAVE STUDENTS LEARNED ABOUT ALGEBRA?

To demonstrate their understanding of algebraic concepts, students were asked to solve a variety of problems involving patterns, relations, expressions, and equations. The country-by-country results for the example algebra items are presented in Table 3.3. Figure 3.3, showing the relationship between performance on these items and performance on the mathematics scale, suggests that even some of the eighth graders in most countries had considerable difficulty with all but the most straightforward algebra questions. Questions involving expressions and equations were most likely to be answered correctly by only the higher-performing students (students achieving approximately at or above the eighth-grade mean of 513).

Example Items 13 through 17 illustrate the range of student performance. As shown by Example Item 13, the easiest items measured concepts underlying algebra such as the ability to detect patterns. In most countries, students performed very well on this item at both grades (87% and 90% correct responses averaged across countries).

Example Item 14 is a two-part item requiring students to supply their answers. In the first part of the item, students generally were able to establish the number of small triangles in the figures (72% and 75% average correct at the seventh and eighth grades, respectively). Of course, finding the answers of 4 and 9 could have been accomplished by actually counting the small triangles. In contrast, very few students demonstrated their ability to extend the pattern and determine that 64 small triangles would be needed for the 8th figure (international averages of 18% and 26%). In only Japan (52%) and Singapore (50%) did at least half the eighth-grade students provide a correct response to this question.

Example Items 15, 16, and 17 required students to work with algebraic equations and expressions. The international results for Example Item 15 indicate that students in most countries were relatively successful in solving a simple linear equation for x (on average, 62% and 72% correct at the seventh and eighth grades). As shown by the data for Example Item 16, they had more difficulty recognizing that $m + m + m + m$ was equivalent to $4m$ (international averages of 47% and 58%). It should be noted, however, that three-fourths or more of the eighth-grade students answered this question correctly in the Czech Republic, Hong Kong, Japan, the Russian Federation, Singapore, the Slovak Republic, and Slovenia. Considering the performance on Example Item 16, it is not surprising that students had even more difficulty identifying the correct expression to represent the number of Clarissa's hats as required by Example Item 17. International performance on this item averaged 37% at the seventh grade and 47% at the eighth grade.

Table 3.3

Percent Correct for Algebra Example Items Lower and Upper Grades (Seventh and Eighth Grades*)

Country	Example 13 Shapes in a pattern.		Example 14A Sequence of triangles: chart finding pattern.		Example 14B Sequence of triangles: extending pattern.	
	Seventh Grade	Eighth Grade	Seventh Grade	Eighth Grade	Seventh Grade	Eighth Grade
† Belgium (Fl)	96 (0.9)	94 (2.2)	84 (2.1)	83 (2.4)	26 (2.5)	31 (2.9)
† Belgium (Fr)	93 (1.8)	96 (1.4)	87 (2.1)	84 (2.5)	13 (2.2)	22 (2.5)
Canada	91 (1.7)	97 (0.8)	78 (2.0)	82 (1.7)	21 (1.8)	33 (2.4)
Cyprus	73 (2.3)	83 (2.6)	66 (2.5)	69 (2.7)	11 (1.9)	20 (2.4)
Czech Republic	96 (0.9)	98 (0.6)	75 (2.8)	75 (2.4)	19 (2.3)	32 (3.4)
†[2] England	94 (1.9)	95 (1.6)	84 (2.6)	86 (2.4)	20 (2.6)	42 (3.4)
France	93 (1.6)	92 (1.4)	80 (2.1)	80 (2.1)	12 (1.8)	18 (2.5)
Hong Kong	91 (1.8)	90 (2.1)	83 (2.7)	82 (1.9)	43 (2.8)	48 (2.7)
Hungary	93 (1.6)	93 (1.3)	84 (1.9)	91 (1.4)	20 (2.9)	34 (2.8)
Iceland	83 (2.5)	83 (3.7)	74 (3.5)	77 (3.6)	6 (1.7)	16 (2.7)
Iran, Islamic Rep.	88 (2.2)	95 (1.3)	64 (3.0)	65 (2.8)	2 (0.8)	12 (2.7)
Ireland	92 (1.6)	94 (1.3)	72 (2.2)	73 (2.3)	19 (2.0)	25 (2.6)
Japan	97 (0.6)	96 (0.8)	89 (1.4)	94 (0.8)	43 (2.2)	52 (2.2)
Korea	96 (1.2)	97 (0.9)	80 (2.6)	84 (2.1)	32 (2.8)	38 (2.6)
[1] Latvia (LSS)	93 (1.6)	96 (1.2)	67 (2.8)	76 (2.7)	13 (2.2)	17 (2.4)
[1] Lithuania	87 (2.0)	91 (1.9)	56 (3.4)	66 (3.2)	6 (1.6)	13 (2.2)
New Zealand	90 (1.9)	94 (1.2)	72 (2.5)	81 (2.0)	23 (2.5)	31 (2.5)
Norway	88 (2.1)	92 (1.5)	73 (3.0)	77 (2.3)	14 (2.4)	22 (2.4)
Portugal	89 (1.9)	94 (1.3)	62 (2.6)	71 (2.6)	6 (1.5)	13 (1.8)
Russian Federation	92 (1.5)	95 (1.2)	70 (1.8)	76 (2.3)	11 (1.5)	22 (2.0)
† Scotland	89 (1.7)	94 (1.1)	85 (1.9)	89 (1.8)	18 (2.0)	35 (2.8)
Singapore	93 (1.3)	95 (0.8)	79 (2.4)	83 (1.5)	37 (2.9)	50 (2.8)
Slovak Republic	90 (1.7)	92 (1.5)	67 (2.5)	73 (2.4)	15 (1.9)	27 (2.4)
Spain	89 (1.7)	93 (1.3)	71 (2.4)	80 (2.0)	17 (2.2)	22 (2.0)
Sweden	90 (1.7)	89 (1.4)	75 (2.5)	75 (2.1)	8 (1.6)	17 (2.0)
[1] Switzerland	95 (1.1)	95 (1.4)	80 (2.1)	86 (1.7)	27 (2.6)	38 (2.5)
† United States	90 (1.8)	93 (0.8)	73 (2.2)	75 (2.2)	18 (2.4)	25 (1.6)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	91 (1.3)	93 (1.3)	76 (2.5)	80 (1.3)	26 (2.5)	32 (1.8)
Austria	95 (1.4)	95 (1.4)	91 (1.9)	91 (2.1)	27 (2.2)	35 (3.4)
Bulgaria	83 (3.5)	88 (3.4)	69 (4.5)	76 (3.5)	18 (4.3)	18 (3.5)
Netherlands	87 (2.4)	91 (1.9)	82 (2.8)	84 (2.5)	29 (2.9)	38 (3.8)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	44 (3.6)	55 (4.2)	45 (3.9)	46 (4.2)	7 (4.8)	11 (4.1)
†[1] Germany	86 (2.1)	92 (1.6)	79 (2.9)	81 (2.4)	16 (2.4)	18 (2.6)
Romania	83 (2.0)	85 (2.0)	53 (2.9)	63 (2.6)	15 (2.0)	20 (2.4)
Slovenia	87 (2.0)	89 (1.6)	76 (2.2)	82 (2.4)	20 (2.4)	31 (3.2)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	91 (1.6)	93 (1.8)	68 (2.7)	77 (2.9)	13 (2.0)	24 (3.4)
Greece	77 (2.2)	86 (1.6)	69 (2.1)	79 (2.2)	4 (1.0)	13 (2.1)
† South Africa	44 (2.7)	53 (3.3)	19 (2.5)	20 (2.5)	3 (0.9)	3 (1.3)
Thailand	94 (0.9)	96 (0.8)	78 (1.9)	86 (1.3)	19 (1.6)	26 (2.7)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):						
[1] Israel	–	91 (1.4)	–	78 (2.7)	–	25 (3.4)
Kuwait	–	78 (4.1)	–	34 (3.9)	–	20 (4.0)

*Seventh and eighth grades in most countries; See Table 2 for information about the grades tested in each country

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. Israel and Kuwait did not test at the seventh grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 3.3 (Continued)

Percent Correct for Algebra Example Items
Lower and Upper Grades (Seventh and Eighth Grades*)

Country	Example 15 Solve linear equation for x.		Example 16 Equivalent algebraic expressions.		Example 17 Expression representing number of hats.	
	Seventh Grade	**Eighth Grade**	**Seventh Grade**	**Eighth Grade**	**Seventh Grade**	**Eighth Grade**
† **Belgium (Fl)**	84 (2.3)	80 (2.8)	69 (2.8)	69 (4.2)	41 (3.0)	53 (3.8)
† **Belgium (Fr)**	69 (3.4)	76 (2.5)	56 (3.7)	64 (2.7)	35 (3.5)	46 (3.1)
Canada	55 (2.6)	73 (2.6)	40 (2.3)	61 (2.1)	33 (2.5)	45 (2.7)
Cyprus	65 (3.4)	71 (3.2)	43 (2.6)	59 (2.9)	34 (2.9)	47 (3.0)
Czech Republic	81 (2.6)	86 (2.2)	69 (3.2)	75 (2.7)	56 (3.1)	70 (3.7)
†[2] England	51 (3.2)	61 (3.4)	46 (3.6)	42 (3.6)	25 (3.2)	37 (3.0)
France	62 (2.6)	82 (2.3)	53 (2.8)	65 (2.5)	39 (2.7)	55 (2.8)
Hong Kong	87 (2.4)	92 (1.9)	72 (3.3)	79 (3.3)	64 (3.4)	65 (3.2)
Hungary	79 (2.1)	89 (1.7)	61 (2.7)	72 (2.4)	40 (3.2)	57 (3.0)
Iceland	45 (3.7)	56 (3.4)	35 (3.0)	59 (4.0)	11 (2.2)	14 (3.2)
Iran, Islamic Rep.	36 (4.5)	47 (3.7)	31 (3.3)	34 (3.2)	29 (3.2)	38 (3.8)
Ireland	65 (2.6)	72 (3.0)	39 (2.9)	53 (2.8)	44 (2.1)	51 (2.6)
Japan	85 (1.7)	90 (1.3)	60 (2.0)	75 (1.9)	48 (2.3)	57 (2.2)
Korea	87 (1.9)	92 (1.6)	56 (3.1)	65 (2.6)	60 (3.2)	64 (2.7)
[1] Latvia (LSS)	70 (3.1)	75 (2.5)	49 (3.3)	58 (3.0)	45 (3.2)	42 (3.3)
[1] Lithuania	66 (3.3)	72 (3.4)	48 (3.4)	56 (3.8)	39 (3.2)	46 (3.5)
New Zealand	56 (2.9)	69 (2.4)	40 (2.8)	55 (2.6)	27 (2.8)	38 (2.6)
Norway	32 (2.8)	52 (2.5)	42 (4.2)	52 (2.7)	13 (2.8)	23 (2.3)
Portugal	47 (2.6)	60 (2.2)	26 (2.9)	42 (2.9)	30 (2.6)	42 (2.3)
Russian Federation	84 (2.0)	88 (1.7)	61 (2.9)	75 (2.9)	54 (2.5)	58 (3.8)
† Scotland	40 (2.7)	62 (2.8)	53 (3.0)	53 (3.0)	18 (2.1)	36 (3.1)
Singapore	91 (1.7)	96 (0.9)	77 (2.2)	82 (2.0)	78 (2.4)	86 (1.7)
Slovak Republic	83 (1.8)	84 (2.1)	63 (3.1)	77 (2.6)	54 (2.8)	66 (2.6)
Spain	58 (2.8)	76 (2.3)	43 (2.5)	59 (2.7)	46 (2.4)	61 (2.3)
Sweden	42 (2.7)	51 (2.7)	37 (2.5)	51 (2.6)	16 (2.3)	20 (2.0)
[1] Switzerland	54 (2.3)	77 (2.2)	38 (2.5)	54 (2.7)	28 (2.4)	41 (3.1)
† United States	63 (3.8)	73 (2.3)	40 (2.8)	46 (2.5)	39 (2.9)	49 (2.3)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	65 (2.5)	73 (1.6)	51 (2.7)	65 (1.8)	31 (2.3)	45 (2.0)
Austria	70 (2.8)	80 (2.1)	51 (2.7)	73 (2.8)	38 (2.9)	51 (3.1)
Bulgaria	82 (3.1)	84 (2.6)	69 (3.5)	72 (3.1)	64 (5.1)	64 (3.9)
Netherlands	49 (4.0)	65 (4.3)	33 (4.1)	51 (4.5)	27 (2.9)	45 (4.0)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	30 (3.3)	43 (3.7)	19 (3.6)	34 (4.5)	23 (3.5)	33 (3.7)
†[1] Germany	62 (3.6)	79 (2.0)	43 (3.4)	57 (3.3)	27 (2.5)	41 (3.0)
Romania	70 (2.6)	77 (2.7)	57 (2.6)	64 (2.7)	45 (3.0)	52 (3.0)
Slovenia	74 (2.5)	86 (1.8)	55 (2.8)	75 (2.7)	43 (2.8)	55 (3.0)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	53 (3.9)	70 (3.3)	31 (2.7)	36 (3.1)	16 (2.3)	29 (2.8)
Greece	62 (2.2)	75 (2.2)	40 (2.7)	57 (2.5)	29 (2.1)	36 (2.7)
† South Africa	38 (2.1)	39 (2.5)	25 (2.0)	33 (2.7)	21 (2.1)	19 (2.4)
Thailand	71 (2.4)	79 (2.2)	40 (2.5)	49 (3.1)	40 (2.6)	46 (2.6)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):						
[1] Israel	–	86 (2.9)	–	70 (3.7)	–	73 (3.3)
Kuwait	–	50 (3.9)	–	29 (2.8)	–	27 (3.3)

*Seventh and eighth grades in most countries; See Table 2 for information about the grades tested in each country.

† Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

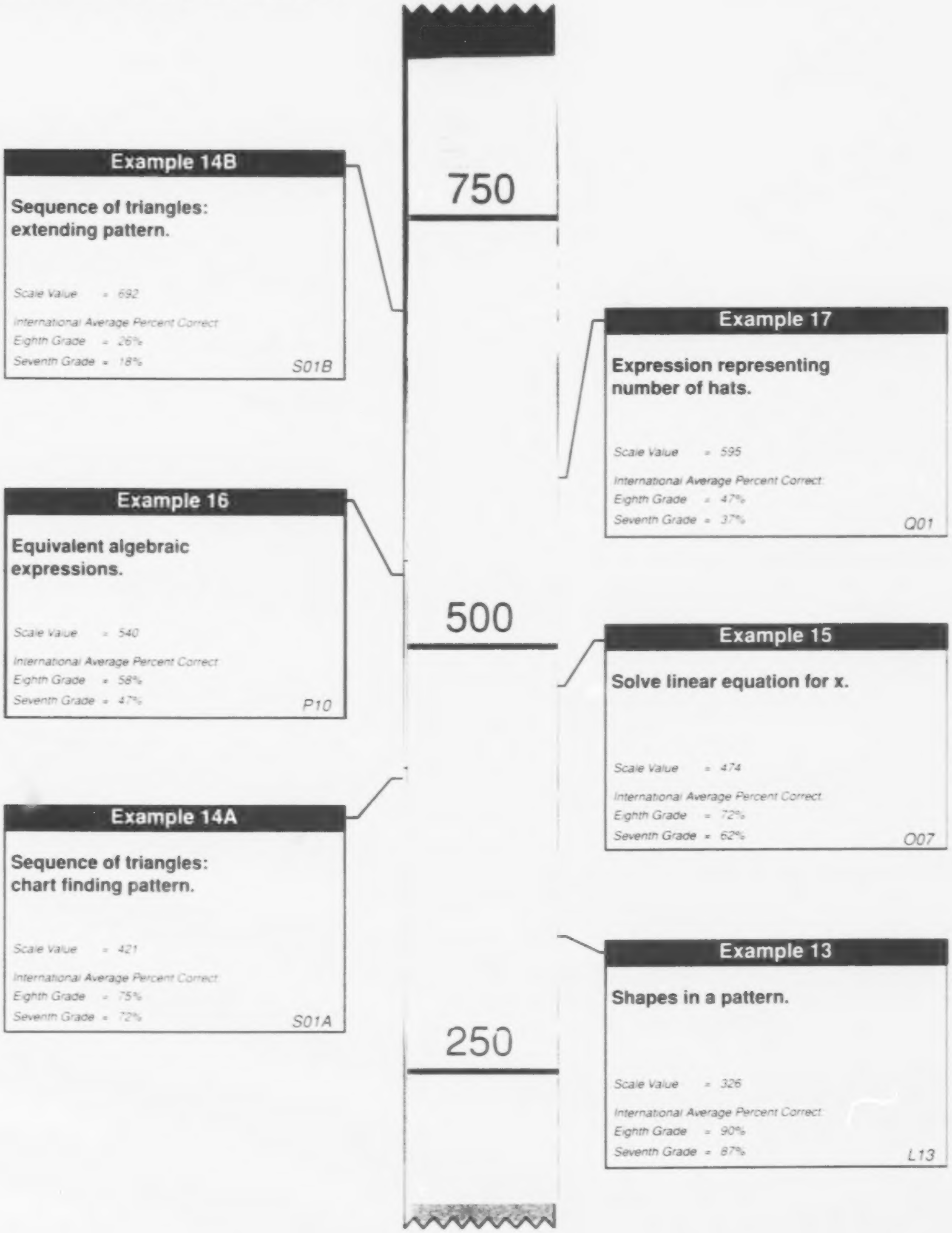
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. Israel and Kuwait did not test at the seventh grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 3.3

International Difficulty Map for Algebra Example Items - Lower and Upper Grades (Seventh and Eighth Grades*)



Example 14B

Sequence of triangles: extending pattern.

Scale Value = 692
International Average Percent Correct:
Eighth Grade = 26%
Seventh Grade = 18%
S01B

Example 17

Expression representing number of hats.

Scale Value = 595
International Average Percent Correct:
Eighth Grade = 47%
Seventh Grade = 37%
Q01

Example 16

Equivalent algebraic expressions.

Scale Value = 540
International Average Percent Correct:
Eighth Grade = 58%
Seventh Grade = 47%
P10

Example 15

Solve linear equation for x.

Scale Value = 474
International Average Percent Correct:
Eighth Grade = 72%
Seventh Grade = 62%
O07

Example 14A

Sequence of triangles: chart finding pattern.

Scale Value = 421
International Average Percent Correct:
Eighth Grade = 75%
Seventh Grade = 72%
S01A

Example 13

Shapes in a pattern.

Scale Value = 326
International Average Percent Correct:
Eighth Grade = 90%
Seventh Grade = 87%
L13

---

*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

NOTE: Each item was placed onto the TIMSS international mathematics scale based on students' performance in both grades. Items are shown at the point on the scale where students with that level of proficiency had a 65 percent probability of providing a correct response.

EXAMPLE ITEM 13
ALGEBRA

Shapes in a pattern

These shapes are arranged in a pattern.

○△○○△△○○○△△△

Which set of shapes is arranged in the same pattern?

A. ★□★□★★□□★★□□
B. □★□□★□□□★□□□□
[✓ C.] ★□★★□□★★★□□□
D. □□★★□★□□★★□★

Performance Category: Knowing

EXAMPLE ITEM 14
ALGEBRA

Sequence of triangles

Here is a sequence of three similar triangles. All of the small triangles are congruent.

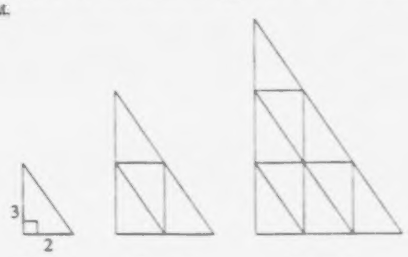


Figure 1 Figure 2 Figure 3

a. Complete the chart by finding how many small triangles make up each figure.

Figure	Number of small triangles
1	1
2	4
3	9

b. The sequence of similar triangles is extended to the 8th Figure. How many small triangles would be needed for Figure 8?

18
9+7+9+11+13+15
18 29

2
18
18
28
64

64 small triangls

Performance Category: Solving Problems

EXAMPLE ITEM 15
ALGEBRA

Solve linear equation for x

If $3(x+5) = 30$, then $x =$

A. 2

[✓ B.] 5

C. 10

D. 95

Performance Category: Performing Routine Procedures

EXAMPLE ITEM 16
ALGEBRA

Equivalent algebraic expressions

If m represents a positive number, which of these is equivalent to $m+m+m+m$?

A. $m+4$

[✓ B.] $4m$

C. m^4

D. $4(m+1)$

Performance Category: Knowing

EXAMPLE ITEM 17
ALGEBRA

Expression representing number of hats

Juan has 5 fewer hats than Maria, and Clarissa has 3 times as many hats as Juan. If Maria has n hats, which of these represents the number of hats that Clarissa has?

A. $5 - 3n$

B. $3n$

C. $n - 5$

D. $3n - 5$

[✓ E.] $3(n - 5)$

Performance Category: Using Complex Procedures

WHAT HAVE STUDENTS LEARNED ABOUT DATA REPRESENTATION, ANALYSIS, AND PROBABILITY?

As illustrated by Example Items 18 through 23, the types of items in this content area required students to represent and analyze data using charts, tables, and graphs and to demonstrate their understanding of basic concepts underlying uncertainty and probability. The results for the example items are presented in Table 3.4. As shown in Figure 3.4, the international difficulty map for data representation, analysis, and probability indicates that the higher performing students were more likely to demonstrate the ability to apply concepts and integrate their understandings.

Example Item 18 asked students to read a chart of daily temperatures. Performance on reading the chart of temperatures was high in nearly all countries (international averages of 85% and 87%). Performance also was relatively high on Example Item 19 which required students to complete a pictograph (international averages of 79% and 81%).

Example Item 21, requiring students to read a line graph, posed a greater challenge for students in many countries. On average, 51% of the students at the seventh grade across countries and 58% at the eighth grade answered this question correctly. There were large differences in performance among countries. At the eighth grade, performance at 75% correct or better was achieved in Flemish-speaking Belgium (82%), France (81%), Japan (75%), Switzerland (77%), the Netherlands (76%), and Denmark (75%). Performance below 45% occurred in Cyprus (40%), Iran (25%), Colombia (20%), Romania (36%), South Africa (17%), and Kuwait (24%).

Example Items 20 and 22 assessed the area of probability. In general, students appeared to understand that the probability of picking the one red marble was highest for the fewest number of marbles (Example Item 20). The international averages were 73% and 76% at the seventh and eighth grades, respectively. Eighty-five percent or more of the students at both grades answered this question correctly in Belgium (Flemish), Canada, Hong Kong, Korea, and the Netherlands. In contrast, asking students to integrate their understanding of both cubes and probability proved to be more difficult for them (Example Item 22). The international averages of correct responses were 41% at the seventh grade and 47% at the eighth grade. Although the eighth-grade students performed quite well in Singapore (88%) and two-thirds or more answered correctly in Flemish-speaking Belgium (68%), Hong Kong (72%), Japan (75%), and Korea (68%), performance fell below 40% correct in a number of countries.

Example Item 23 required students to apply their mathematics understanding to an everyday situation — that of extracting and using appropriate information from a newspaper advertisement to determine which office space had the lower rent. Students were asked to show their work. Although the scoring approach provided information about partial solutions to the problem, the results reported herein for each country are for those students receiving complete credit for the item. That is, students indicated that Building A had the lower price and showed accurate computations to support this conclusion. Performance was quite low in most of the countries. Only in Singapore (55%) did more than half the eighth-grade students provide a complete solution to this problem, although performance in Japan (47%) and Korea (50%) also was higher than in other countries.

Table 3.4

Percent Correct for Data Representation, Analysis, and Probability Example Items
Lower and Upper Grades (Seventh and Eighth Grades*)

Country	Example 18 Highest temperature on chart.		Example 19 Pictograph of number of students.		Example 20 Chance of picking red marble.	
	Seventh Grade	**Eighth Grade**	**Seventh Grade**	**Eighth Grade**	**Seventh Grade**	**Eighth Grade**
† **Belgium (Fl)**	94 (1.4)	91 (2.5)	93 (1.2)	86 (3.8)	90 (1.9)	86 (1.9)
† Belgium (Fr)	92 (1.7)	90 (2.3)	84 (2.3)	82 (2.8)	83 (2.4)	85 (2.3)
Canada	90 (1.6)	92 (1.7)	91 (1.3)	89 (1.5)	85 (1.9)	90 (1.1)
Cyprus	72 (2.7)	78 (2.5)	75 (2.5)	82 (1.8)	63 (2.4)	68 (2.9)
Czech Republic	97 (1.0)	96 (0.8)	76 (2.4)	84 (2.3)	66 (2.6)	76 (2.8)
†2 England	89 (2.1)	91 (2.2)	87 (2.7)	92 (1.7)	81 (2.7)	86 (2.3)
France	89 (1.7)	90 (1.7)	85 (1.9)	88 (1.6)	82 (2.4)	82 (2.3)
Hong Kong	85 (1.9)	79 (2.8)	86 (2.0)	81 (2.0)	85 (2.5)	89 (1.6)
Hungary	92 (1.5)	91 (1.4)	83 (2.0)	87 (1.7)	77 (2.3)	82 (2.1)
Iceland	88 (2.0)	90 (2.2)	87 (2.8)	87 (2.9)	76 (3.0)	77 (2.8)
Iran, Islamic Rep.	72 (3.1)	75 (2.9)	52 (3.3)	67 (2.9)	31 (5.4)	37 (3.1)
Ireland	90 (1.5)	92 (1.6)	84 (2.0)	89 (1.8)	76 (2.3)	82 (2.1)
Japan	94 (1.0)	93 (1.1)	93 (0.9)	94 (1.0)	81 (1.7)	83 (1.4)
Korea	82 (2.4)	85 (1.8)	92 (1.7)	90 (1.6)	86 (2.0)	91 (1.6)
1 Latvia (LSS)	80 (2.6)	86 (2.2)	72 (2.4)	82 (1.9)	51 (2.8)	60 (3.0)
1 Lithuania	74 (3.2)	87 (2.1)	59 (3.3)	75 (2.8)	56 (3.1)	68 (2.9)
New Zealand	91 (1.9)	93 (1.3)	87 (1.9)	92 (1.4)	74 (2.3)	82 (1.7)
Norway	88 (2.0)	92 (1.5)	85 (2.3)	86 (1.9)	79 (2.8)	85 (1.7)
Portugal	84 (2.0)	90 (1.6)	78 (2.1)	86 (1.8)	60 (2.4)	67 (2.3)
Russian Federation	84 (2.2)	91 (1.5)	77 (2.2)	78 (2.2)	63 (2.8)	70 (2.5)
† Scotland	89 (1.7)	91 (1.7)	83 (1.8)	88 (1.7)	77 (2.4)	82 (2.0)
Singapore	80 (2.1)	88 (1.4)	92 (1.3)	94 (1.1)	82 (2.0)	81 (1.9)
Slovak Republic	90 (1.5)	93 (1.4)	79 (2.0)	80 (2.0)	70 (2.4)	70 (2.6)
Spain	86 (1.7)	88 (1.7)	77 (2.5)	86 (1.7)	80 (2.2)	83 (2.0)
Sweden	93 (1.5)	94 (1.3)	86 (1.9)	87 (1.5)	84 (1.7)	81 (1.9)
1 Switzerland	94 (1.1)	92 (1.8)	86 (2.3)	88 (2.1)	81 (2.5)	86 (1.4)
† United States	89 (1.7)	90 (1.1)	87 (1.5)	89 (1.2)	82 (1.9)	86 (1.2)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	94 (1.1)	92 (1.4)	91 (1.4)	88 (1.4)	79 (2.1)	84 (1.6)
Austria	90 (1.5)	91 (1.9)	84 (2.5)	87 (2.1)	77 (2.6)	82 (2.3)
Bulgaria	82 (3.5)	81 (2.8)	74 (3.6)	75 (4.1)	77 (3.6)	85 (3.8)
Netherlands	92 (2.0)	89 (2.4)	89 (2.3)	87 (3.6)	89 (2.1)	91 (1.9)
Countries Not Meeting Age Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	66 (2.9)	71 (4.0)	53 (3.6)	64 (4.2)	40 (3.4)	47 (4.0)
†1 Germany	89 (2.1)	87 (2.2)	83 (2.0)	82 (2.7)	78 (2.1)	83 (2.2)
Romania	72 (3.1)	69 (2.8)	64 (3.0)	64 (2.7)	52 (2.8)	52 (2.7)
Slovenia	93 (1.3)	95 (1.2)	82 (1.8)	77 (2.0)	81 (2.1)	85 (2.2)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	93 (1.8)	92 (2.1)	84 (2.7)	88 (2.2)	76 (2.5)	83 (2.2)
Greece	78 (2.2)	85 (1.7)	63 (2.7)	77 (2.5)	61 (2.2)	71 (1.9)
† South Africa	48 (2.7)	55 (2.6)	17 (2.5)	17 (3.1)	30 (2.5)	28 (2.8)
Thailand	83 (1.8)	86 (1.5)	93 (1.3)	94 (1.0)	74 (2.0)	76 (1.9)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):						
1 Israel	–	89 (2.2)	–	87 (3.3)	–	77 (3.2)
Kuwait	–	82 (2.7)	–	29 (4.6)	–	53 (4.4)

*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. Israel and Kuwait did not test at the seventh grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 3.4 (Continued)

Percent Correct for Data Representation, Analysis, and Probability Example Items
Lower and Upper Grades (Seventh and Eighth Grades*)

Country	Example 21 Speed of car from graph. Seventh Grade	Example 21 Speed of car from graph. Eighth Grade	Example 22 Number of red cube faces. Seventh Grade	Example 22 Number of red cube faces. Eighth Grade	Example 23 Price of renting office space. Seventh Grade	Example 23 Price of renting office space. Eighth Grade
† **Belgium (Fl)**	76 (2.6)	82 (3.8)	73 (3.1)	68 (2.7)	25 (2.3)	23 (1.9)
† Belgium (Fr)	60 (2.8)	64 (3.8)	55 (3.2)	61 (3.8)	14 (1.5)	20 (2.5)
Canada	55 (2.2)	66 (1.9)	49 (2.6)	57 (2.2)	16 (1.5)	24 (1.7)
Cyprus	41 (2.6)	40 (3.2)	37 (2.8)	46 (3.0)	5 (0.7)	8 (1.6)
Czech Republic	57 (3.1)	71 (2.8)	39 (3.2)	36 (3.2)	18 (1.8)	28 (2.6)
†[2] England	66 (2.8)	69 (3.1)	36 (3.2)	39 (3.1)	12 (1.5)	20 (2.0)
France	75 (2.1)	81 (2.5)	43 (3.0)	54 (3.0)	16 (1.5)	26 (2.1)
Hong Kong	65 (2.9)	65 (2.5)	70 (3.2)	72 (2.7)	25 (2.3)	37 (2.5)
Hungary	57 (3.0)	61 (2.7)	43 (2.7)	55 (2.8)	11 (1.2)	20 (1.6)
Iceland	37 (3.6)	56 (4.3)	36 (2.9)	57 (4.2)	6 (1.3)	15 (1.8)
Iran, Islamic Rep.	17 (3.2)	25 (2.8)	26 (2.4)	24 (3.9)	1 (0.4)	1 (0.4)
Ireland	50 (2.6)	63 (2.4)	58 (2.4)	64 (3.3)	18 (1.6)	25 (2.3)
Japan	71 (1.9)	75 (1.8)	69 (2.1)	75 (1.6)	38 (1.5)	47 (1.5)
Korea	61 (2.5)	67 (2.6)	66 (2.7)	68 (3.2)	38 (2.1)	50 (1.8)
[1] Latvia (LSS)	43 (3.2)	57 (3.0)	22 (2.1)	28 (3.0)	5 (1.2)	9 (1.2)
[1] Lithuania	47 (3.0)	53 (3.3)	18 (2.7)	22 (2.9)	3 (0.9)	7 (1.2)
New Zealand	51 (2.6)	66 (2.6)	37 (2.6)	52 (2.4)	15 (1.5)	22 (2.0)
Norway	58 (3.4)	73 (2.3)	42 (3.5)	57 (2.6)	16 (1.8)	23 (1.6)
Portugal	38 (2.4)	49 (2.6)	18 (1.9)	21 (1.9)	4 (0.7)	8 (0.9)
Russian Federation	49 (3.2)	49 (3.0)	29 (2.7)	33 (2.6)	11 (1.3)	14 (1.7)
† Scotland	60 (3.2)	70 (2.7)	36 (2.9)	48 (3.3)	12 (1.4)	20 (2.3)
Singapore	57 (2.5)	67 (2.0)	80 (2.1)	88 (1.7)	49 (2.6)	55 (2.0)
Slovak Republic	42 (2.5)	56 (2.8)	37 (2.4)	43 (2.9)	10 (1.3)	15 (1.7)
Spain	39 (2.7)	47 (2.6)	24 (2.1)	34 (2.6)	6 (0.8)	15 (1.3)
Sweden	62 (3.0)	74 (2.3)	45 (3.1)	55 (2.7)	18 (1.9)	23 (1.7)
[1] Switzerland	67 (2.9)	77 (2.3)	55 (2.7)	64 (3.0)	16 (1.5)	26 (1.5)
† United States	59 (2.9)	72 (1.9)	37 (3.3)	47 (3.0)	15 (2.2)	18 (1.6)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	62 (2.3)	72 (1.7)	49 (2.8)	53 (2.2)	18 (1.6)	22 (1.3)
Austria	59 (2.9)	74 (2.2)	47 (2.7)	54 (3.3)	17 (1.6)	25 (1.8)
Bulgaria	35 (3.7)	49 (4.3)	38 (4.0)	46 (5.7)	9 (1.5)	6 (1.4)
Netherlands	70 (3.4)	76 (3.8)	60 (3.3)	62 (3.6)	14 (2.2)	24 (2.6)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	16 (2.2)	20 (2.7)	16 (2.6)	15 (2.0)	1 (0.4)	1 (0.5)
†[1] Germany	68 (2.8)	69 (3.2)	50 (3.8)	45 (3.5)	14 (1.9)	14 (1.7)
Romania	31 (2.6)	36 (2.8)	20 (2.2)	33 (2.8)	7 (1.2)	12 (1.7)
Slovenia	57 (2.8)	57 (2.9)	33 (2.7)	42 (2.7)	12 (1.5)	20 (1.6)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	60 (4.0)	75 (2.8)	36 (3.9)	46 (2.9)	12 (2.0)	22 (2.2)
Greece	29 (2.1)	48 (2.8)	34 (2.1)	38 (2.6)	9 (1.2)	13 (1.2)
† South Africa	17 (1.9)	17 (2.3)	12 (1.7)	15 (1.9)	2 (0.8)	2 (1.1)
Thailand	48 (2.4)	56 (2.7)	40 (2.8)	55 (2.9)	13 (1.7)	21 (2.5)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):						
[1] Israel	–	56 (4.1)	–	53 (4.4)	–	15 (2.5)
Kuwait	–	24 (3.9)	–	19 (3.7)	–	4 (1.2)

*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

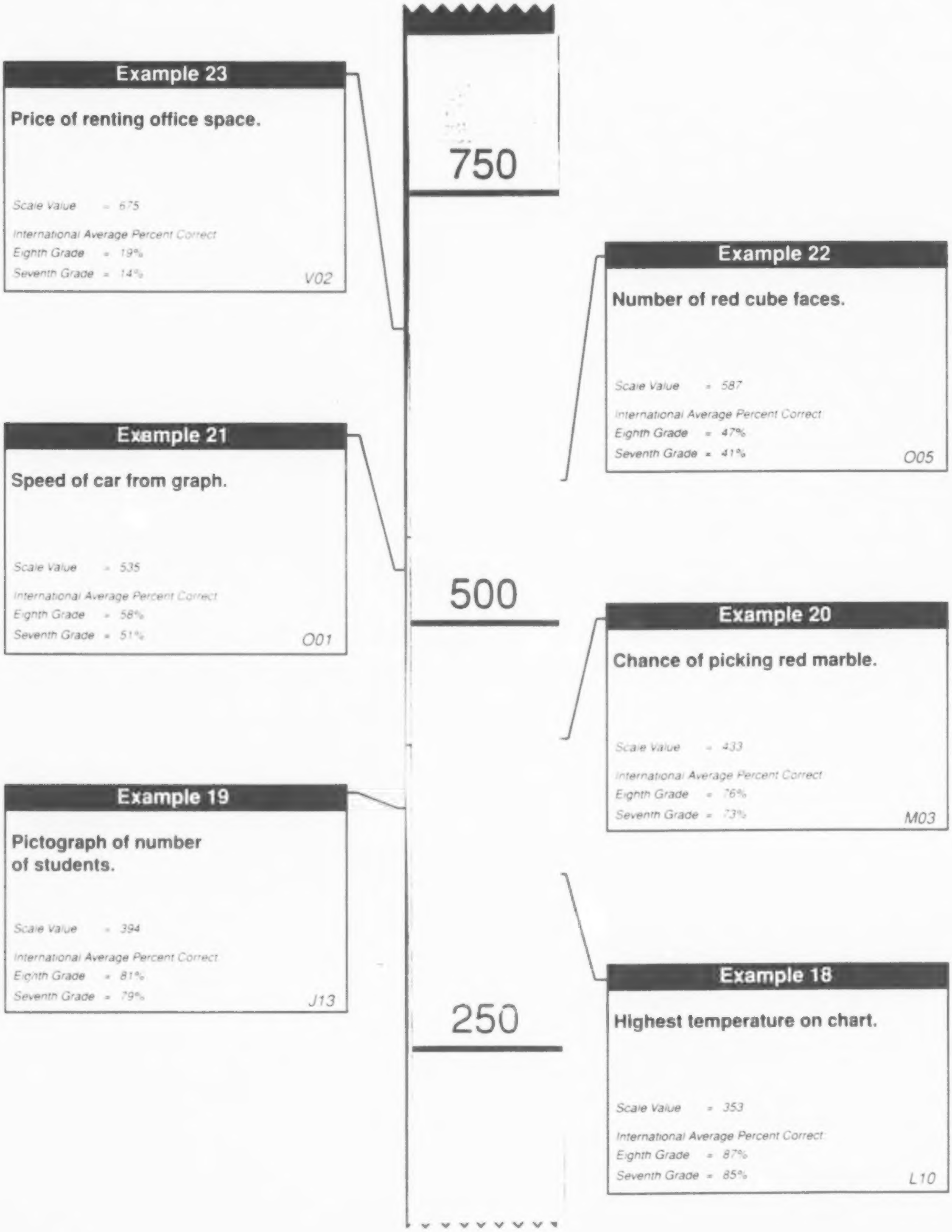
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. Israel and Kuwait did not test at the seventh grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 3.4

International Difficulty Map for Data Representation, Analysis, and Probability Example Items
Lower and Upper Grades (Seventh and Eighth Grades*)



Example 23

Price of renting office space.

Scale Value = 675

International Average Percent Correct
Eighth Grade = 19%
Seventh Grade = 14%
V02

Example 22

Number of red cube faces.

Scale Value = 587

International Average Percent Correct
Eighth Grade = 47%
Seventh Grade = 41%
O05

Example 21

Speed of car from graph.

Scale Value = 535

International Average Percent Correct
Eighth Grade = 58%
Seventh Grade = 51%
O01

Example 20

Chance of picking red marble.

Scale Value = 433

International Average Percent Correct
Eighth Grade = 76%
Seventh Grade = 73%
M03

Example 19

Pictograph of number of students.

Scale Value = 394

International Average Percent Correct
Eighth Grade = 81%
Seventh Grade = 79%
J13

Example 18

Highest temperature on chart.

Scale Value = 353

International Average Percent Correct
Eighth Grade = 87%
Seventh Grade = 85%
L10

---

*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

NOTE: Each item was placed onto the TIMSS international mathematics scale based on students' performance in both grades. Items are shown at the point on the scale where students with that level of proficiency had a 65 percent probability of providing a correct response.

EXAMPLE ITEM 18
DATA REPRESENTATION, ANALYSIS & PROBABILITY

Highest temperature on chart

This chart shows temperature readings made at different times on four days.

TEMPERATURES					
	6 a.m.	9 a.m.	Noon	3 p.m.	8 p.m.
Monday	15°	17°	20°	21°	19°
Tuesday	15°	15°	15°	10°	9°
Wednesday	8°	10°	14°	13°	15°
Thursday	8°	11°	14°	17°	20°

When was the highest temperature recorded?

A. Noon on Monday

[✓ B.] 3 p.m. on Monday

C. Noon on Tuesday

D. 3 p.m. on Wednesday

Performance Category: Using Complex Procedures

EXAMPLE ITEM 19
DATA REPRESENTATION, ANALYSIS & PROBABILITY

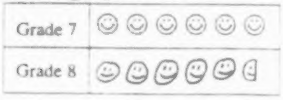
Pictograph of number of students

The table shows the number of students in the 7th and 8th grades in a given school.

Grade	Number of Students
7	60
8	55

Complete the Grade 8 row in the pictograph below to represent the number of students in each grade.

One ☺ represents 10 students



Performance Category: Using Complex Procedures

EXAMPLE ITEM 20
DATA REPRESENTATION, ANALYSIS & PROBABILITY

Chance of picking red marble

There is only one red marble in each of these bags.

Without looking in the bags, you are to pick a marble out of one of the bags. Which bag would give you the greatest chance of picking the red marble?

[✓ A.] The bag with 10 marbles

B. The bag with 100 marbles

C. The bag with 1000 marbles

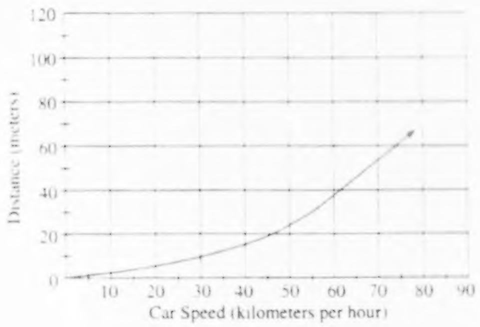
D. All bags would give the same chance.

Performance Category: Solving Problems

EXAMPLE ITEM 21
DATA REPRESENTATION, ANALYSIS & PROBABILITY

Speed of car from graph

The graph shows the distance traveled before coming to a stop after the brakes are applied for a typical car traveling at different speeds.



A car traveling on a highway stopped 30 m after the brakes were applied. About how fast was the car traveling?

A. 48 km per hour

[✓ B.] 55 km per hour

C. 70 km per hour

D. 160 km per hour

Performance Category: Solving Problems

EXAMPLE ITEM 22
DATA REPRESENTATION, ANALYSIS & PROBABILITY

Number of red cube faces

Each of the six faces of a certain cube is painted either red or blue. When the cube is tossed, the probability of the cube landing with a red face up is $\frac{2}{3}$. How many faces are red?

A. One

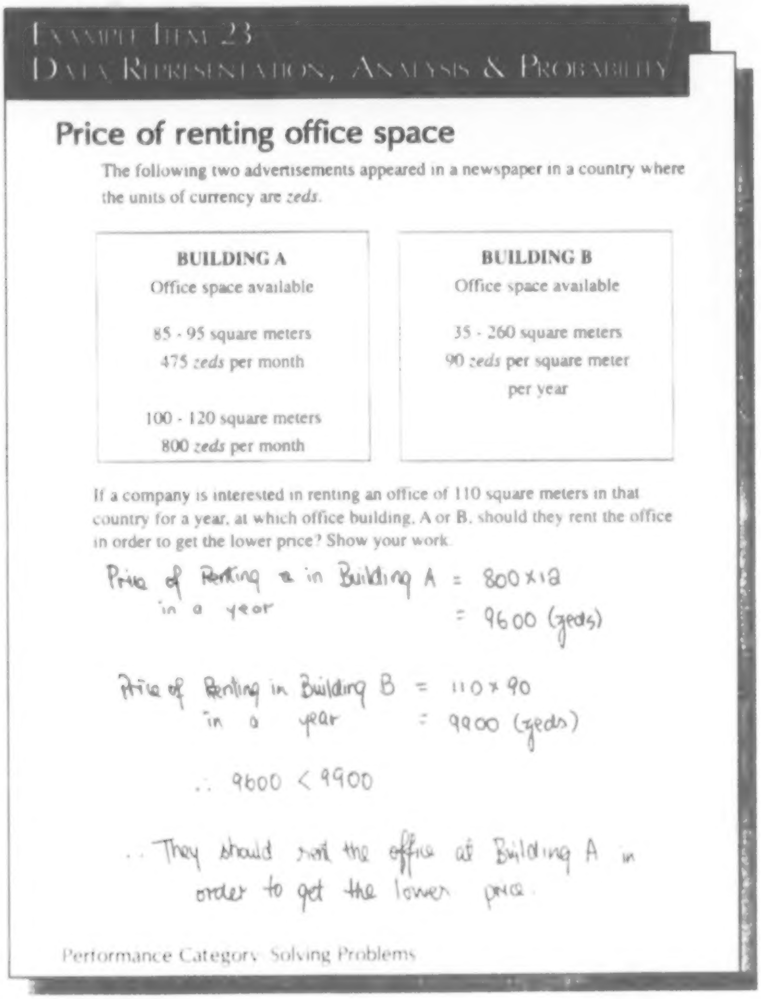
B. Two

C. Three

[✓ D.] Four

E. Five

Performance Category: Solving Problems



EXAMPLE ITEM 23
DATA REPRESENTATION, ANALYSIS & PROBABILITY

Price of renting office space

The following two advertisements appeared in a newspaper in a country where the units of currency are *zeds*.

BUILDING A
Office space available

85 - 95 square meters
475 *zeds* per month

100 - 120 square meters
800 *zeds* per month

BUILDING B
Office space available

35 - 260 square meters
90 *zeds* per square meter
per year

If a company is interested in renting an office of 110 square meters in that country for a year, at which office building, A or B, should they rent the office in order to get the lower price? Show your work.

Price of Renting ~~a~~ in Building A = 800×12
in a year = 9600 (zeds)

Price of Renting in Building B = 110×90
in a year = 9900 (zeds)

∴ 9600 < 9900

∴ They should rent the office at Building A in order to get the lower price.

Performance Category: Solving Problems

WHAT HAVE STUDENTS LEARNED ABOUT MEASUREMENT?

The measurement items focused on students' understanding of units of length, weight, time, area, and volume as well as on interpreting scales of measures. Table 3.5 contains the percent-correct results for the example items in measurement, numbered Example Items 24 through 29. The international difficulty map for the measurement items (Figure 3.5) indicates that only the students with higher-than-average mathematics scores internationally were likely to demonstrate an ability to use measurement skills in situations involving several steps.

A more detailed look at performance on the example items suggests that students in many countries had a solid grasp of a variety of measuring units and how to interpret them. Students in most countries were able to read the weight shown on the scale (Example Item 24). The international averages on this item were 83% at the seventh grade and 87% at the eighth grade. Students also did relatively well on Example

Item 25 about pacing off the width of a room (on average, 69% and 74% at the seventh and eighth grades). This item required some thought to understand that the longer the paces, the fewer required to cross the room. The most prevalent misconception was to indicate that the greatest number of paces was related to the longest pace.

Example Item 26 required familiarity with the number of degrees in circles or parts of circles to identify the angle closest to 30 degrees. On average, it was answered correctly by 62% and 64% of the seventh- and eighth-grade students, respectively. For this item, the pattern of increased performance between the grades was fairly inconsistent, with a number of countries having the same or lower performance at the eighth as at the seventh grade.

Internationally, approximately half the students at the seventh and eighth grades (on average, 49% and 52%) were able to determine 10.5 cm as the length of the pencil (Example Item 27). Performance was generally consistent across most countries, although at the eighth grade, students did particularly well in Switzerland (73%), Austria (73%), and Germany (72%). They had the most difficulty in South Africa (17%).

Example Item 28 was a two-part task that first required students to actually draw a new rectangle whose length was one and one-half times the length of a given rectangle and whose width was half the width of that rectangle. All correctly drawn and labeled 9 cm by 2 cm rectangles were given full credit. In the second part of the item, students were asked to determine the ratio of the area of the new rectangle to the area of the one shown. In most countries, students had considerable difficulty with the first part of this multifaceted task, and even more trouble with the second part (even though the scoring for full credit permitted correct ratios based on incorrect drawings). On average, just 24% of the seventh-grade students and 31% of those at eighth grade provided a correct drawing of the new rectangle. In only two countries did at least half the eighth-grade students correctly draw the new rectangle, Korea (54%) and Austria (51%). Fewer than 20% were successful in Iceland (18%), the United States (16%), Colombia (5%), South Africa (4%), and Kuwait (10%). Internationally, the second part of the item was very difficult. On average, just 6% and 10% of the students at the two grades provided a correct ratio between the newly drawn and given rectangles.

Table 3.5

Percent Correct for Measurement Example Items
Lower and Upper Grades (Seventh and Eighth Grades*)

Country	Example 24 Weight shown on scale.		Example 25 Measuring the width of a room.		Example 26 Angle closest to 30 degrees.	
	Seventh Grade	**Eighth Grade**	**Seventh Grade**	**Eighth Grade**	**Seventh Grade**	**Eighth Grade**
† **Belgium (Fl)**	95 (1.3)	98 (0.7)	86 (2.1)	86 (2.7)	64 (2.6)	64 (3.2)
† Belgium (Fr)	92 (1.8)	89 (2.7)	81 (2.7)	84 (2.0)	73 (3.0)	67 (2.7)
Canada	88 (1.9)	90 (1.6)	60 (2.7)	70 (2.3)	62 (2.7)	65 (2.1)
Cyprus	67 (2.4)	72 (2.4)	54 (3.1)	63 (2.9)	60 (2.7)	64 (2.8)
Czech Republic	89 (1.8)	92 (1.7)	81 (2.1)	94 (1.4)	76 (2.9)	76 (3.0)
†[2] England	85 (2.3)	94 (1.7)	62 (3.0)	73 (3.5)	63 (3.1)	62 (2.9)
France	93 (1.8)	94 (1.5)	79 (2.0)	81 (2.6)	64 (2.6)	76 (2.5)
Hong Kong	92 (1.5)	91 (1.7)	70 (2.9)	72 (2.8)	69 (2.6)	68 (2.3)
Hungary	92 (1.4)	92 (1.5)	62 (2.6)	59 (2.6)	71 (2.3)	77 (2.3)
Iceland	86 (2.2)	88 (2.2)	71 (3.6)	80 (4.0)	76 (2.6)	61 (4.4)
Iran, Islamic Rep.	61 (2.7)	71 (2.9)	40 (3.3)	57 (3.3)	52 (3.1)	63 (2.7)
Ireland	83 (2.2)	91 (1.7)	81 (2.1)	83 (2.0)	54 (2.6)	63 (2.6)
Japan	94 (1.0)	97 (0.6)	81 (1.7)	86 (1.3)	77 (2.0)	76 (1.8)
Korea	94 (1.3)	95 (1.2)	73 (2.8)	77 (2.2)	77 (2.5)	76 (2.2)
[1] Latvia (LSS)	82 (2.5)	84 (2.2)	78 (2.6)	91 (1.5)	64 (2.9)	65 (3.0)
[1] Lithuania	77 (2.4)	84 (2.2)	64 (3.3)	74 (3.4)	60 (3.1)	63 (2.9)
New Zealand	86 (1.9)	91 (1.4)	57 (3.3)	69 (2.3)	55 (2.8)	63 (2.4)
Norway	85 (2.1)	88 (1.7)	73 (2.9)	79 (2.2)	70 (3.0)	70 (2.0)
Portugal	81 (2.1)	84 (2.0)	73 (2.5)	79 (2.2)	48 (2.4)	48 (2.8)
Russian Federation	83 (2.2)	92 (1.3)	81 (2.2)	89 (1.5)	71 (2.4)	72 (2.8)
† Scotland	86 (1.8)	92 (1.5)	58 (3.0)	66 (3.0)	53 (2.7)	58 (2.7)
Singapore	93 (1.1)	96 (0.9)	70 (3.0)	77 (2.3)	73 (2.4)	73 (1.9)
Slovak Republic	88 (1.7)	88 (1.6)	82 (1.8)	88 (1.7)	79 (1.9)	74 (2.4)
Spain	73 (2.4)	83 (1.8)	74 (2.1)	81 (1.7)	56 (2.9)	59 (2.3)
Sweden	87 (1.6)	92 (1.3)	82 (2.0)	86 (1.8)	57 (2.6)	61 (2.5)
[1] Switzerland	92 (1.6)	97 (1.1)	90 (1.5)	87 (1.6)	51 (2.7)	73 (2.4)
† United States	83 (1.9)	87 (1.7)	36 (3.4)	48 (2.6)	55 (1.9)	57 (1.7)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	89 (1.7)	94 (0.9)	63 (2.8)	70 (1.9)	63 (1.6)	64 (2.3)
Austria	88 (1.6)	90 (2.2)	80 (2.9)	86 (2.3)	80 (2.6)	74 (3.1)
Bulgaria	80 (2.9)	87 (4.4)	82 (3.2)	77 (3.4)	62 (4.0)	78 (3.3)
Netherlands	94 (1.9)	97 (1.1)	85 (2.4)	82 (3.0)	52 (4.7)	64 (3.3)
Countries Not Meeting Age Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	53 (4.3)	58 (4.5)	45 (3.6)	55 (3.8)	32 (3.6)	37 (3.6)
†[1] Germany	93 (1.6)	94 (1.6)	79 (2.3)	79 (2.4)	65 (2.6)	63 (2.8)
Romania	72 (2.5)	74 (2.3)	65 (2.8)	70 (2.9)	58 (2.8)	59 (2.9)
Slovenia	89 (1.6)	95 (1.3)	87 (2.0)	90 (1.7)	80 (2.4)	77 (2.6)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	88 (2.3)	88 (1.6)	75 (2.7)	80 (2.6)	61 (2.8)	69 (3.1)
Greece	79 (1.8)	86 (1.7)	61 (2.1)	70 (2.2)	56 (2.5)	64 (2.3)
† South Africa	49 (2.8)	52 (2.5)	18 (2.1)	23 (2.7)	33 (2.5)	34 (2.5)
Thailand	90 (1.4)	92 (1.1)	72 (2.5)	81 (1.8)	70 (2.2)	78 (1.7)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):						
[1] Israel	–	86 (3.5)	–	79 (3.3)	–	50 (4.2)
Kuwait	–	58 (2.5)	–	39 (3.6)	–	49 (3.7)

*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. Israel and Kuwait did not test at the seventh grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 3.5 (Continued)

Percent Correct for Measurement Example Items Lower and Upper Grades (Seventh and Eighth Grades*)

Country	Example 27 Approximate length of pencil.		Example 28A New rectangle: Draw from ratio of sides		Example 28B New rectangle: Ratio of areas	
	Seventh Grade	Eighth Grade	Seventh Grade	Eighth Grade	Seventh Grade	Eighth Grade
† Belgium (Fl)	72 (2.5)	69 (3.3)	47 (2.4)	48 (2.2)	7 (1.1)	9 (1.2)
† Belgium (Fr)	45 (3.7)	57 (3.7)	40 (2.6)	43 (2.5)	6 (1.4)	5 (1.1)
Canada	50 (2.9)	53 (2.0)	21 (1.5)	27 (1.7)	8 (0.7)	17 (1.2)
Cyprus	35 (2.9)	40 (3.4)	27 (2.0)	35 (2.1)	11 (1.5)	20 (1.8)
Czech Republic	63 (2.6)	67 (2.6)	27 (1.8)	36 (2.4)	5 (1.0)	13 (2.0)
†2 England	44 (3.7)	52 (3.0)	21 (1.9)	28 (2.1)	8 (1.1)	12 (1.9)
France	55 (2.9)	61 (2.6)	34 (2.3)	43 (2.2)	2 (0.5)	6 (0.9)
Hong Kong	59 (2.8)	60 (3.2)	39 (2.8)	46 (2.8)	17 (1.7)	25 (2.4)
Hungary	56 (2.9)	58 (2.6)	37 (1.9)	43 (2.1)	3 (0.6)	9 (0.9)
Iceland	27 (3.6)	27 (2.6)	11 (1.4)	18 (2.3)	1 (0.6)	5 (1.4)
Iran, Islamic Rep.	34 (2.9)	34 (3.3)	13 (2.0)	24 (2.0)	4 (1.1)	8 (1.4)
Ireland	40 (3.1)	52 (2.4)	26 (2.1)	35 (2.5)	18 (1.7)	20 (1.8)
Japan	52 (2.2)	64 (2.3)	–	–	–	–
Korea	56 (2.6)	60 (2.7)	48 (2.2)	54 (2.1)	31 (2.1)	39 (2.5)
1 Latvia (LSS)	56 (2.5)	60 (2.5)	29 (2.3)	31 (2.3)	5 (1.2)	6 (1.4)
1 Lithuania	37 (3.5)	41 (3.1)	14 (1.8)	24 (2.1)	0 (0.2)	6 (1.0)
New Zealand	48 (2.9)	52 (2.7)	17 (1.8)	27 (1.7)	3 (0.5)	8 (1.4)
Norway	52 (4.8)	62 (2.4)	21 (2.2)	32 (1.7)	2 (0.4)	2 (0.5)
Portugal	37 (3.3)	43 (2.7)	14 (1.3)	22 (1.8)	2 (0.6)	2 (0.5)
Russian Federation	51 (2.4)	59 (3.1)	27 (1.8)	39 (2.8)	7 (1.4)	17 (2.0)
† Scotland	39 (2.4)	45 (3.0)	19 (1.7)	27 (2.7)	3 (0.7)	12 (2.2)
Singapore	62 (2.6)	64 (2.3)	–	–	–	–
Slovak Republic	55 (2.7)	63 (2.8)	29 (1.8)	35 (2.1)	10 (1.3)	15 (1.5)
Spain	43 (3.0)	52 (2.6)	18 (1.6)	28 (1.7)	1 (0.4)	2 (0.4)
Sweden	61 (2.9)	67 (2.0)	18 (1.5)	30 (1.9)	6 (0.9)	11 (1.2)
1 Switzerland	70 (2.5)	73 (2.6)	37 (2.4)	47 (1.9)	3 (0.5)	7 (1.0)
† United States	46 (2.7)	45 (2.2)	11 (1.4)	16 (1.6)	10 (1.6)	10 (0.9)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	49 (2.2)	55 (1.9)	22 (1.5)	31 (1.6)	8 (0.9)	15 (1.2)
Austria	66 (3.0)	73 (2.5)	41 (2.0)	51 (2.8)	4 (1.0)	8 (1.3)
Bulgaria	43 (4.6)	45 (4.5)	35 (4.1)	27 (3.7)	9 (2.1)	10 (3.1)
Netherlands	68 (3.2)	62 (3.3)	31 (2.5)	40 (3.2)	6 (1.2)	8 (1.5)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	30 (2.9)	29 (2.5)	3 (0.8)	5 (1.0)	0 (0.0)	0 (0.2)
†1 Germany	70 (2.2)	72 (3.0)	28 (2.2)	34 (2.6)	2 (0.5)	4 (0.8)
Romania	40 (2.6)	41 (2.6)	23 (2.0)	28 (2.1)	10 (1.6)	15 (1.9)
Slovenia	60 (2.6)	70 (2.8)	26 (2.0)	37 (2.3)	5 (1.3)	10 (1.4)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	49 (3.6)	52 (3.2)	16 (1.8)	24 (2.1)	3 (0.8)	5 (1.0)
Greece	28 (2.4)	33 (2.5)	15 (1.4)	23 (1.8)	4 (0.7)	12 (1.3)
† South Africa	20 (1.9)	17 (2.1)	4 (0.9)	4 (1.3)	0 (0.2)	0 (0.2)
Thailand	49 (2.2)	57 (2.5)	16 (1.7)	20 (1.7)	9 (2.1)	12 (1.5)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):						
1 Israel	–	44 (4.4)	–	48 (3.1)	–	7 (1.7)
Kuwait	–	31 (5.4)	–	10 (2.7)	–	6 (2.5)

*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

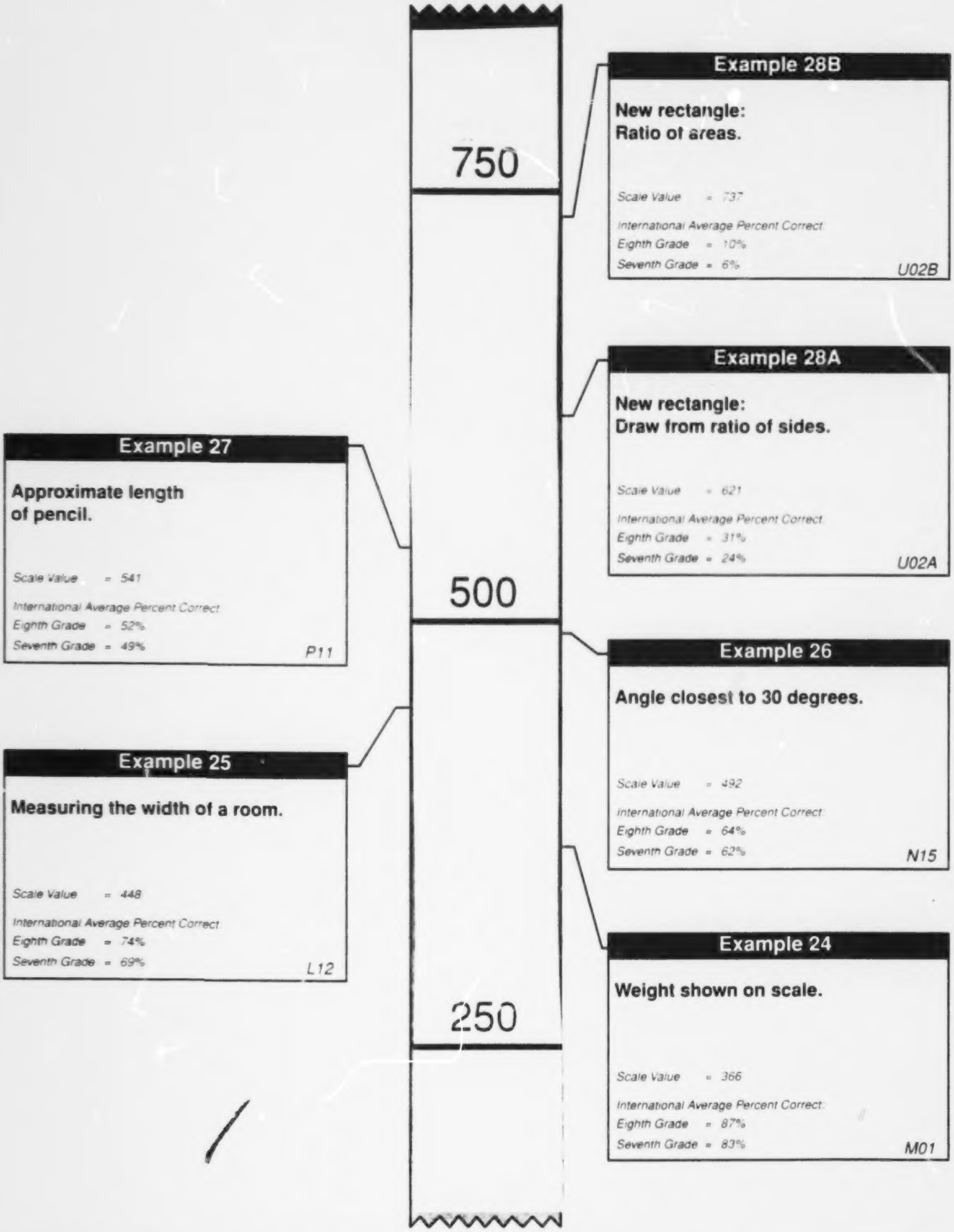
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. Israel and Kuwait did not test at the seventh grade. Internationally comparable data are unavailable for Japan and Singapore on Examples 28A & 28B.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 3.5

International Difficulty Map for Measurement Example Items Lower and Upper Grades (Seventh and Eighth Grades*)



Example 28B

New rectangle: Ratio of areas.

Scale Value = 737

International Average Percent Correct:
Eighth Grade = 10%
Seventh Grade = 6%

U02B

Example 28A

New rectangle: Draw from ratio of sides.

Scale Value = 621

International Average Percent Correct:
Eighth Grade = 31%
Seventh Grade = 24%

U02A

Example 27

Approximate length of pencil.

Scale Value = 541

International Average Percent Correct:
Eighth Grade = 52%
Seventh Grade = 49%

P11

Example 26

Angle closest to 30 degrees.

Scale Value = 492

International Average Percent Correct:
Eighth Grade = 64%
Seventh Grade = 62%

N15

Example 25

Measuring the width of a room.

Scale Value = 448

International Average Percent Correct:
Eighth Grade = 74%
Seventh Grade = 69%

L12

Example 24

Weight shown on scale.

Scale Value = 366

International Average Percent Correct:
Eighth Grade = 87%
Seventh Grade = 83%

M01

---

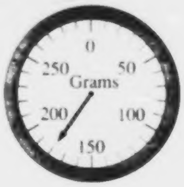
*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

NOTE: Each item was placed onto the TIMSS international mathematics scale based on students' performance in both grades. Items are shown at the point on the scale where students with that level of proficiency had a 65 percent probability of providing a correct response.

EXAMPLE ITEM 24
MEASUREMENT

Weight shown on scale

What is the weight (mass) shown on the scale?



- A. 153 g
- B. 160 g
- C. 165 g
- [✓ D.] 180 g

Performance Category: Knowing

EXAMPLE ITEM 25
MEASUREMENT

Measuring the width of a room

Four children measured the width of a room by counting how many paces it took them to cross it. The chart shows their measurements.

Name	Number of Paces
Stephen	10
Erlane	8
Ana	9
Carlos	7

Who had the longest pace?

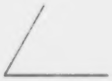
- A. Stephen
- B. Erlane
- C. Ana
- [✓ D.] Carlos

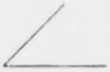
Performance Category: Solving Problems

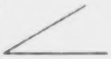
EXAMPLE ITEM 26
MEASUREMENT

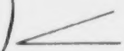
Angle closest to 30 degrees

Which of these angles has a measure closest to 30°?

A.


B.


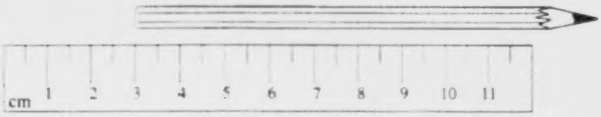
[✓ C.]


D.


Performance Category: Knowing

EXAMPLE ITEM 27
MEASUREMENT

Approximate length of pencil



Which of these is closest to the length of the pencil in the figure?

A. 9 cm

[✓ B.] 10.5 cm

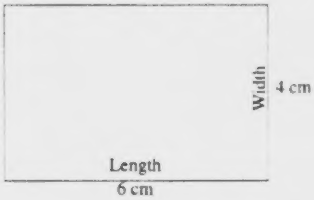
C. 12 cm

D. 13.5 cm

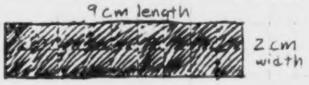
Performance Category: Using Complex Procedures

EXAMPLE ITEM 28
MEASUREMENT

New Rectangle



a. In the space below, draw a new rectangle whose length is one and one half times the length of the rectangle above, and whose width is half the width of the rectangle above. Show the length and width of the new rectangle in centimeters on the figure.



b. What is the ratio of the area of the new rectangle to the area of the first one?

Show your work.

new Δ $= 18\text{cm}^2 \div 3 = 6$
old Δ $= 24\text{cm}^2 \div 3 = 8$
$\frac{6}{8}$ or $\frac{3}{4}$

3 to 4

Performance Category: Solving Problems

WHAT HAVE STUDENTS LEARNED ABOUT PROPORTIONALITY?

A small set (11) of the mathematics items was designed to focus specifically on proportionality concepts and problems. Arguably, these items could have been classified in other content areas, usually fractions and number sense, but the decision was made to analyze them separately because they assess an important kind of mathematical reasoning. Example Items 29 through 33 illustrate these types of questions. The percent of correct responses for each country for the example items are provided in Table 3.6.

As described previously in Chapter 2, this item group was relatively more difficult for students than those for the other content areas. Figure 3.6 shows the extreme difficulty of these items for students. Only those students scoring above 600 on the mathematics scale were likely to answer most of these types of questions correctly.

Example Item 29, the least difficult of the items shown here, was one of the few proportionality items answered correctly by the majority of students in most countries. The item asked about adding 5 boys and 5 girls to a class that was three-fifths girls. On average, 62% of the students at seventh grade and 65% at eighth grade correctly answered that there would still be more girls than boys in the class.

Despite the overall difficulty encountered by students in this content area, there was an extremely large range in performance across countries. Example Item 32, requiring the students to determine the number of girls in a class of 28 based on the ratio of girls to boys, illustrates the extent of the difference in achievement levels. At the eighth grade, the question was answered correctly by 92% of the students in Singapore compared to very few in Colombia (12%), Greece (13%), South Africa (9%), and Kuwait (12%).

Table 3.6

Percent Correct for Proportionality Example Items Lower and Upper Grades (Seventh and Eighth Grades[*])

Country	Example 29 More boys or girls in class.		Example 30 Ratio of red paint in mixture		Example 31 Amount paid for portion of items	
	Seventh Grade	Eighth Grade	Seventh Grade	Eighth Grade	Seventh Grade	Eighth Grade
[†] Belgium (Fl)	85 (2.1)	82 (2.9)	47 (2.4)	48 (2.4)	57 (3.4)	58 (4.1)
[†] Belgium (Fr)	74 (2.6)	76 (2.8)	45 (2.8)	49 (2.9)	34 (3.5)	41 (3.1)
Canada	68 (2.4)	66 (2.5)	46 (2.1)	56 (1.8)	22 (2.1)	26 (2.3)
Cyprus	59 (2.9)	63 (2.7)	35 (2.0)	34 (2.1)	21 (2.6)	30 (3.0)
Czech Republic	60 (3.5)	70 (2.7)	19 (1.9)	29 (1.9)	47 (3.3)	63 (2.8)
[†2] England	66 (3.4)	69 (3.3)	34 (2.2)	39 (2.7)	14 (1.9)	17 (2.9)
France	66 (2.7)	75 (2.4)	48 (2.0)	51 (2.5)	38 (2.6)	54 (2.9)
Hong Kong	79 (2.1)	78 (1.7)	67 (2.8)	70 (2.4)	52 (3.3)	62 (3.2)
Hungary	60 (2.8)	67 (2.3)	29 (1.9)	36 (2.1)	30 (2.4)	42 (2.5)
Iceland	70 (3.4)	66 (4.6)	26 (2.2)	49 (4.1)	15 (2.7)	25 (4.1)
Iran, Islamic Rep.	51 (3.3)	51 (3.2)	27 (2.2)	31 (2.3)	15 (2.3)	19 (2.6)
Ireland	71 (2.7)	78 (2.4)	37 (1.9)	42 (2.3)	32 (2.8)	41 (3.3)
Japan	76 (1.9)	82 (1.9)	57 (1.5)	66 (1.4)	61 (2.2)	71 (2.0)
Korea	78 (2.1)	82 (2.2)	78 (1.8)	87 (1.4)	63 (2.3)	62 (2.5)
[1] Latvia (LSS)	44 (3.1)	57 (3.4)	23 (2.0)	27 (1.9)	25 (2.7)	39 (2.9)
[1] Lithuania	44 (3.1)	51 (3.0)	8 (1.2)	14 (1.5)	28 (3.4)	36 (3.2)
New Zealand	69 (2.5)	70 (2.3)	43 (2.3)	47 (1.9)	19 (2.4)	22 (2.0)
Norway	70 (4.2)	73 (2.4)	28 (2.2)	37 (2.0)	16 (2.5)	27 (2.4)
Portugal	39 (2.2)	50 (2.6)	16 (1.6)	21 (1.6)	9 (1.5)	20 (2.5)
Russian Federation	47 (3.1)	47 (2.5)	27 (2.0)	39 (2.6)	50 (2.5)	49 (3.8)
[†] Scotland	65 (2.4)	71 (2.7)	38 (2.2)	38 (2.2)	12 (2.0)	19 (2.6)
Singapore	83 (1.9)	85 (1.7)	89 (1.6)	95 (0.8)	79 (2.4)	83 (1.8)
Slovak Republic	57 (2.6)	62 (2.5)	24 (2.0)	32 (2.1)	38 (3.1)	54 (2.7)
Spain	63 (2.3)	62 (3.0)	24 (1.6)	34 (1.7)	30 (2.4)	42 (2.7)
Sweden	68 (2.5)	74 (2.0)	50 (2.1)	64 (1.7)	21 (2.2)	30 (2.0)
[1] Switzerland	73 (2.2)	76 (2.2)	39 (2.1)	42 (1.9)	47 (2.0)	60 (2.4)
[†] United States	58 (2.5)	62 (2.2)	45 (2.0)	53 (1.8)	18 (2.8)	23 (2.2)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):						
Australia	71 (2.2)	74 (1.4)	41 (1.7)	42 (2.0)	21 (1.9)	31 (1.8)
Austria	69 (2.5)	73 (2.7)	21 (2.4)	21 (1.9)	56 (3.2)	67 (3.0)
Bulgaria	65 (5.4)	57 (4.4)	28 (3.2)	37 (3.8)	46 (8.5)	34 (4.4)
Netherlands	85 (2.7)	77 (2.7)	58 (2.8)	65 (2.7)	44 (4.7)	41 (3.7)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):						
Colombia	26 (3.0)	30 (3.9)	14 (2.3)	15 (2.1)	3 (1.1)	7 (1.6)
[†1] Germany	70 (2.7)	67 (3.3)	26 (2.0)	26 (2.1)	29 (2.9)	37 (3.4)
Romania	48 (2.6)	52 (3.0)	29 (2.0)	39 (2.4)	30 (2.3)	32 (2.6)
Slovenia	62 (2.7)	66 (2.5)	29 (2.3)	39 (2.2)	39 (2.6)	52 (3.0)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):						
Denmark	54 (3.3)	68 (2.9)	30 (2.4)	31 (2.1)	16 (2.2)	28 (2.6)
Greece	55 (2.4)	59 (2.5)	41 (1.9)	50 (2.1)	33 (2.4)	39 (2.7)
[†] South Africa	32 (2.8)	31 (2.2)	18 (1.4)	16 (1.5)	2 (1.0)	2 (0.8)
Thailand	55 (2.4)	56 (2.7)	44 (2.2)	55 (2.4)	37 (2.9)	43 (2.9)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):						
[1] Israel	–	75 (4.0)	–	39 (4.2)	–	42 (4.8)
Kuwait	–	25 (4.1)	–	14 (2.1)	–	2 (0.8)

[*] Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

[†] Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. Israel and Kuwait did not test at the seventh grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 3.6 (Continued)

Percent Correct for Proportionality Example Items Lower and Upper Grades (Seventh and Eighth Grades*)

Country	Example 32 Number of girls from boy girl ratio.		Example 33 Missing values in proportionality table.	
	Seventh Grade	**Eighth Grade**	**Seventh Grade**	**Eighth Grade**
† Belgium (Fl)	37 (2.6)	34 (3.7)	27 (2.5)	33 (2.9)
† Belgium (Fr)	38 (3.0)	48 (3.1)	14 (2.1)	19 (2.6)
Canada	28 (2.4)	43 (2.4)	24 (2.3)	26 (2.1)
Cyprus	18 (2.4)	24 (2.6)	18 (2.3)	24 (2.4)
Czech Republic	47 (3.3)	60 (3.7)	21 (3.1)	30 (3.2)
†2 England	40 (3.5)	42 (3.4)	15 (2.8)	18 (3.0)
France	29 (2.8)	43 (3.1)	30 (2.3)	33 (2.6)
Hong Kong	47 (3.3)	63 (3.3)	32 (2.3)	38 (2.9)
Hungary	37 (2.7)	57 (2.6)	19 (2.1)	24 (2.4)
Iceland	22 (3.3)	18 (3.1)	9 (2.0)	14 (3.2)
Iran, Islamic Rep.	19 (2.6)	22 (2.4)	20 (3.0)	31 (4.3)
Ireland	56 (2.9)	56 (2.9)	21 (2.1)	25 (2.1)
Japan	47 (1.9)	53 (1.8)	48 (2.2)	49 (2.2)
Korea	58 (3.1)	64 (2.6)	34 (3.1)	41 (2.6)
1 Latvia (LSS)	21 (3.0)	32 (3.1)	12 (1.9)	21 (2.6)
1 Lithuania	13 (2.7)	30 (2.7)	6 (1.4)	14 (2.2)
New Zealand	30 (2.7)	37 (2.5)	13 (1.8)	19 (2.1)
Norway	15 (2.2)	19 (2.2)	11 (1.8)	15 (1.8)
Portugal	8 (1.4)	17 (1.8)	19 (2.1)	21 (2.3)
Russian Federation	25 (2.1)	37 (3.1)	20 (2.5)	27 (2.3)
† Scotland	26 (2.6)	37 (3.3)	14 (2.2)	15 (2.4)
Singapore	89 (1.7)	92 (1.3)	42 (2.9)	47 (2.8)
Slovak Republic	46 (3.1)	58 (2.7)	27 (2.5)	27 (2.9)
Spain	14 (1.7)	24 (2.2)	16 (1.7)	10 (1.5)
Sweden	19 (2.0)	24 (2.0)	11 (1.4)	14 (1.8)
1 Switzerland	26 (2.4)	38 (2.5)	20 (2.1)	29 (2.4)
† United States	27 (2.6)	34 (2.3)	19 (2.2)	20 (1.6)
Countries Not Satisfying Guidelines for Sample Participation Rates (See Appendix A for Details):				
Australia	33 (2.4)	50 (2.3)	18 (2.1)	22 (1.7)
Austria	42 (4.0)	46 (2.6)	15 (1.9)	18 (2.1)
Bulgaria	46 (5.5)	54 (4.3)	22 (4.9)	44 (6.4)
Netherlands	43 (3.5)	43 (4.6)	33 (3.3)	29 (3.1)
Countries Not Meeting Age/Grade Specifications (High Percentage of Older Students; See Appendix A for Details):				
Colombia	11 (3.4)	12 (2.0)	10 (1.9)	11 (2.2)
†1 Germany	19 (2.6)	30 (3.4)	11 (1.7)	18 (2.2)
Romania	22 (2.6)	29 (2.7)	22 (2.5)	29 (2.9)
Slovenia	19 (2.1)	43 (2.7)	17 (2.5)	24 (2.1)
Countries With Unapproved Sampling Procedures at Classroom Level (See Appendix A for Details):				
Denmark	25 (3.1)	35 (3.5)	10 (1.9)	13 (2.3)
Greece	10 (1.5)	13 (1.9)	26 (2.6)	30 (2.3)
† South Africa	5 (1.5)	9 (1.7)	13 (1.3)	13 (1.4)
Thailand	37 (2.7)	48 (2.7)	36 (2.3)	39 (2.5)
Unapproved Sampling Procedures at Classroom Level and Not Meeting Other Guidelines (See Appendix A for Details):				
1 Israel	–	22 (3.4)	–	17 (2.8)
Kuwait	–	12 (3.5)	–	15 (2.0)

*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

†Met guidelines for sample participation rates only after replacement schools were included (see Appendix A for details).

[1] National Desired Population does not cover all of International Desired Population (see Table A.2). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table A.2).

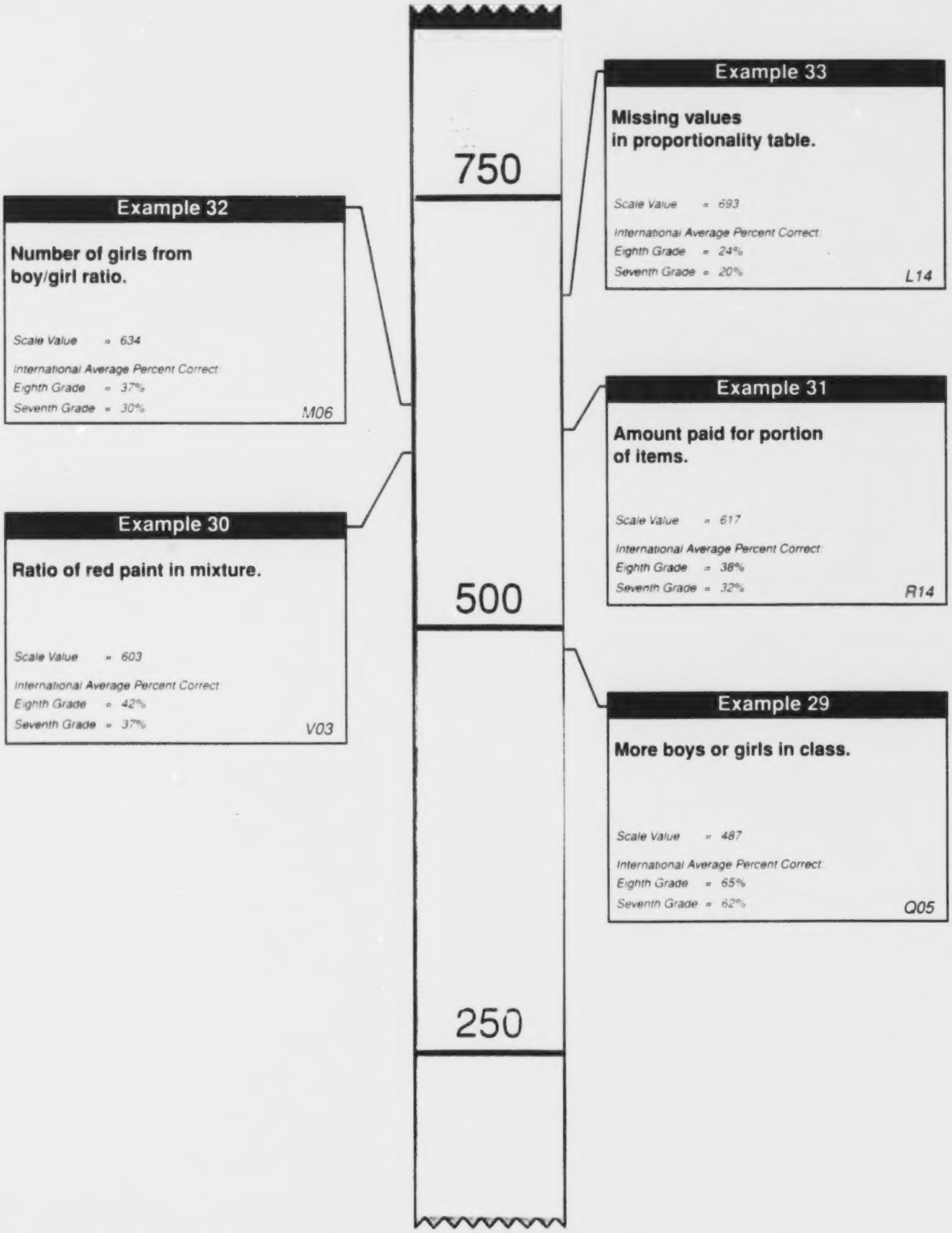
( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (–) indicates data are not available. Israel and Kuwait did not test at the seventh grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 3.6

International Difficulty Map for Proportionality Example Items Lower and Upper Grades (Seventh and Eighth Grades*)



Example 33

Missing values in proportionality table.

Scale Value = 693

International Average Percent Correct:

Eighth Grade = 24%

Seventh Grade = 20%

L14

Example 32

Number of girls from boy/girl ratio.

Scale Value = 634

International Average Percent Correct

Eighth Grade = 37%

Seventh Grade = 30%

M06

Example 31

Amount paid for portion of items.

Scale Value = 617

International Average Percent Correct:

Eighth Grade = 38%

Seventh Grade = 32%

R14

Example 30

Ratio of red paint in mixture.

Scale Value = 603

International Average Percent Correct

Eighth Grade = 42%

Seventh Grade = 37%

V03

Example 29

More boys or girls in class.

Scale Value = 487

International Average Percent Correct:

Eighth Grade = 65%

Seventh Grade = 62%

Q05

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*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

NOTE: Each item was placed onto the TIMSS international mathematics scale based on students' performance in both grades. Items are shown at the point on the scale where students with that level of proficiency had a 65 percent probability of providing a correct response.

Example Item 29
Proportionality

More boys or girls in class

Three-fifths of the students in a class are girls. If 5 girls and 5 boys are added to the class, which statement is true of the class?

[✓ A.] There are more girls than boys.

B. There are the same number of girls as there are boys.

C. There are more boys than girls.

D. You cannot tell whether there are more girls or boys from the information given.

Performance Category: Solving Problems

Example Item 30
Proportionality

Ratio of red paint in mixture

To mix a certain color of paint, Alana combines 5 liters of red paint, 2 liters of blue paint, and 2 liters of yellow paint. What is the ratio of red paint to the total amount of paint?

A. $\frac{5}{2}$

B. $\frac{9}{4}$

C. $\frac{5}{4}$

[✓ D.] $\frac{5}{9}$

Performance Category: Performing Routine Procedures

EXAMPLE ITEM 31
PROPORTIONALITY

Amount paid for portion of items

Peter bought 70 items and Sue bought 90 items. Each item cost the same and the items cost $800 altogether. How much did Sue pay?

16|800

3
160
x 5
800

90
x5.0
450

Answer: Sue paid $450

Performance Category: Solving Problems

EXAMPLE ITEM 32
PROPORTIONALITY

Number of girls from boy/girl ratio

A class has 28 students. The ratio of girls to boys is 4 : 3. How many girls are in the class?

$\frac{28}{7} \times 4 = 4 \times 4$

Answer: 16

Performance Category: Solving Problems

EXAMPLE ITEM 33
PROPORTIONALITY

Missing values in proportionality table

The table shows the values of *x* and y, where *x* is proportional to y.

x	3	6	*P*
y	7	*Q*	35

What are the values of *P* and *Q* ?

A. $P = 14$ and $Q = 31$

B. $P = 10$ and $Q = 14$

C. $P = 10$ and $Q = 31$

D. $P = 14$ and $Q = 15$

[✓ E.] $P = 15$ and $Q = 14$

Performance Category: Performing Routine Procedures

Chapter 4

Students' Backgrounds and Attitudes Towards Mathematics

To provide an educational context for interpreting the mathematics achievement results, TIMSS collected a full range of descriptive information from students about their backgrounds as well as their activities in and out of school. This chapter presents eighth-grade students' responses to a selected subset of these questions. In an effort to explore the degree to which the students' home and social environment fostered academic development, some of the questions presented herein address the availability of educational resources in the home. Another group of questions is provided to help examine whether or not students typically spend their out-of-school time in ways that support their in-school academic performance. Because students' attitudes and opinions about mathematics reflect what happens in school and their perceptions of the value of mathematics in broader social contexts, results also are described for several questions from the affective domain. More specifically, these questions asked students to express their opinions about the abilities necessary for success in mathematics, provide information about what motivates them to do well in mathematics, and indicate their attitudes towards mathematics.

Student and teacher questionnaire data for two countries are unavailable for this report and thus do not appear in this chapter – Bulgaria and South Africa. Bulgaria had complications with data entry, and South Africa joined the study later than the other countries.

What Educational Resources Do Students Have in Their Homes?

Students specifically were asked about the availability at home of three types of educational resources – a dictionary, a study desk or table for their own use, and a computer. Table 4.1 reveals that in most countries eighth-grade students with all three of these educational study aids had higher mathematics achievement than students who did not have ready access to these study aids. In almost all the countries, nearly all students reported having a dictionary in their homes. There was more variation among countries in the percentages of students reporting their own study desk or table. Of the three study aids, the most variation was in the number of eighth-grade students reporting having a home computer. In several countries, more than 70% of students reported having a computer in the home, including the more than 85% who so reported in England, the Netherlands, and Scotland. For these three countries, it is likely that these high percentages include computers used for entertainment purposes, such as computer games.

The number of books in the home can be an indicator of a home environment that values literacy, the acquisition of knowledge, and general academic support. Table 4.2 presents eighth-grade students' reports about the number of books in their homes in relation to their achievement on the TIMSS mathematics test. In most countries, the more books students reported in the home, the higher their mathematics

Table 4.1

Students' Reports on Educational Aids in the Home: Dictionary, Study Desk/Table and Computer - Mathematics - Upper Grade (Eighth Grade*)

Country	Have All Three Educational Aids		Do Not Have All Three Educational Aids		Have Dictionary	Have Study Desk/Table for Own Use	Have Computer
	Percent of Students	**Mean Achievement**	**Percent of Students**	**Mean Achievement**	**Percent of Students**	**Percent of Students**	**Percent of Students**
Australia	66 (1.2)	542 (4.3)	34 (1.2)	509 (4.5)	88 (0.7)	97 (0.4)	73 (1.2)
Austria	56 (1.5)	548 (3.6)	44 (1.5)	530 (3.9)	98 (0.3)	93 (0.8)	59 (1.5)
Belgium (Fl)	64 (1.3)	577 (4.9)	36 (1.3)	547 (7.2)	99 (0.5)	96 (0.5)	67 (1.3)
Belgium (Fr)	58 (1.4)	541 (3.3)	42 (1.4)	510 (4.8)	97 (0.5)	96 (0.5)	60 (1.4)
Canada	57 (1.4)	539 (2.4)	43 (1.4)	513 (3.2)	97 (0.4)	89 (0.6)	61 (1.3)
Colombia	10 (1.2)	407 (9.3)	90 (1.2)	383 (3.4)	96 (0.5)	84 (1.0)	11 (1.2)
Cyprus	37 (0.9)	486 (2.8)	63 (0.9)	468 (2.4)	97 (0.3)	96 (0.5)	39 (0.9)
Czech Republic	33 (1.3)	583 (5.8)	67 (1.3)	555 (5.0)	94 (0.6)	90 (0.6)	36 (1.2)
Denmark	66 (1.5)	510 (3.0)	34 (1.5)	492 (4.6)	85 (1.1)	98 (0.3)	76 (1.2)
England	80 (1.0)	512 (3.1)	20 (1.0)	485 (5.6)	98 (0.4)	90 (0.8)	89 (0.8)
France	49 (1.3)	547 (3.6)	51 (1.3)	531 (3.6)	99 (0.2)	96 (0.4)	50 (1.3)
Germany	66 (1.1)	515 (4.3)	34 (1.1)	500 (5.5)	98 (0.4)	93 (0.6)	71 (1.0)
Greece	28 (1.0)	502 (5.4)	72 (1.0)	478 (2.8)	97 (0.3)	93 (0.5)	29 (1.0)
Hong Kong	33 (1.8)	606 (7.3)	67 (1.8)	582 (6.5)	99 (0.1)	80 (1.1)	39 (1.9)
Hungary	32 (1.2)	574 (3.7)	68 (1.2)	523 (3.4)	77 (1.2)	92 (0.7)	37 (1.2)
Iceland	72 (1.6)	490 (5.2)	28 (1.6)	479 (4.5)	95 (0.5)	96 (0.6)	77 (1.4)
Iran, Islamic Rep.	1 (0.3)	~ ~	99 (0.3)	430 (2.2)	54 (1.5)	40 (2.0)	4 (0.4)
Ireland	67 (1.2)	536 (5.2)	33 (1.2)	514 (6.3)	99 (0.3)	86 (0.9)	78 (1.1)
Israel	75 (2.1)	534 (5.8)	25 (2.1)	497 (8.8)	100 (0.2)	98 (0.4)	76 (2.1)
Japan	- -	- -	- -	- -	- -	- -	- -
Korea	38 (1.2)	635 (3.6)	62 (1.2)	591 (2.7)	98 (0.2)	95 (0.4)	39 (1.2)
Kuwait	38 (2.0)	398 (3.8)	62 (2.0)	389 (2.6)	84 (1.1)	73 (2.0)	53 (2.1)
Latvia (LSS)	13 (0.8)	492 (5.4)	87 (0.8)	495 (3.1)	94 (0.6)	98 (0.3)	13 (0.9)
Lithuania	35 (1.3)	485 (4.0)	65 (1.3)	474 (4.0)	88 (1.0)	95 (0.6)	42 (1.4)
Netherlands	83 (1.3)	545 (8.2)	17 (1.3)	524 (7.7)	100 (0.1)	99 (0.2)	85 (1.2)
New Zealand	56 (1.4)	522 (5.0)	44 (1.4)	491 (4.6)	99 (0.2)	91 (0.6)	60 (1.3)
Norway	63 (1.1)	512 (2.7)	37 (1.1)	489 (2.9)	97 (0.3)	98 (0.2)	64 (1.1)
Portugal	35 (1.8)	471 (3.6)	65 (1.8)	446 (2.2)	98 (0.4)	84 (0.9)	39 (1.8)
Romania	6 (1.0)	531 (8.5)	92 (1.0)	479 (3.8)	60 (1.6)	69 (1.3)	19 (1.2)
Russian Federation	30 (1.4)	541 (5.5)	70 (1.4)	534 (6.1)	88 (1.1)	95 (0.7)	35 (1.5)
Scotland	74 (1.2)	506 (5.8)	26 (1.2)	480 (6.6)	96 (0.5)	84 (1.2)	90 (0.6)
Singapore	47 (1.5)	657 (5.0)	53 (1.5)	631 (5.1)	99 (0.1)	92 (0.5)	49 (1.5)
Slovak Republic	27 (1.2)	570 (4.3)	73 (1.2)	539 (3.6)	96 (0.5)	86 (0.9)	31 (1.2)
Slovenia	43 (1.4)	563 (3.7)	57 (1.4)	525 (3.4)	94 (0.5)	93 (0.6)	47 (1.3)
Spain	40 (1.3)	501 (2.9)	60 (1.3)	479 (2.1)	99 (0.1)	93 (0.5)	42 (1.2)
Sweden	58 (1.3)	532 (2.9)	42 (1.3)	501 (3.5)	94 (0.4)	100 (0.1)	60 (1.3)
Switzerland	63 (1.2)	555 (3.2)	37 (1.2)	531 (3.6)	97 (0.4)	95 (0.4)	66 (1.2)
Thailand	4 (0.8)	577 (14.9)	96 (0.8)	521 (5.4)	68 (2.1)	66 (2.1)	4 (0.9)
United States	56 (1.7)	521 (4.7)	44 (1.7)	474 (4.2)	97 (0.4)	90 (0.7)	59 (1.7)

*Eighth grade in most countries: see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Table 4.2

Students' Reports on the Number of Books in the Home
Mathematics - Upper Grade (Eighth Grade*)

Country	None or Very Few (0-10 Books)		About One Shelf (11-25 Books)		About One Bookcase (26-100 Books)		About Two Bookcases (101-200 Books)		Three or More Bookcases (More than 200 Books)	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	3 (0.3)	449 (7.2)	7 (0.6)	482 (5.4)	24 (0.8)	512 (3.7)	25 (0.6)	534 (4.1)	42 (1.4)	555 (4.7)
Austria	11 (1.0)	485 (5.8)	17 (1.1)	505 (4.8)	31 (1.2)	534 (3.9)	17 (0.9)	567 (5.7)	24 (1.4)	579 (4.5)
Belgium (Fl)	11 (1.2)	521 (11.6)	18 (0.8)	549 (8.0)	33 (1.0)	571 (4.9)	18 (1.0)	587 (4.9)	21 (0.9)	575 (7.1)
Belgium (Fr)	7 (0.7)	461 (11.5)	10 (0.7)	484 (6.0)	28 (1.1)	517 (4.7)	21 (0.9)	537 (4.0)	34 (1.5)	555 (4.1)
Canada	4 (0.3)	505 (8.4)	10 (0.7)	510 (5.7)	28 (1.0)	528 (3.4)	25 (0.8)	532 (3.2)	33 (1.4)	534 (3.4)
Colombia	26 (1.5)	376 (5.5)	31 (1.1)	375 (3.7)	27 (1.3)	395 (3.8)	9 (0.7)	404 (7.7)	7 (1.0)	402 (10.4)
Cyprus	6 (0.6)	428 (7.6)	18 (0.8)	448 (3.4)	34 (0.8)	479 (2.9)	23 (0.8)	494 (3.8)	20 (0.8)	490 (4.0)
Czech Republic	1 (0.2)	~ ~	4 (0.5)	506 (8.1)	30 (1.5)	539 (4.9)	32 (0.9)	569 (6.4)	34 (1.8)	588 (5.8)
Denmark	3 (0.6)	452 (13.5)	9 (0.8)	471 (6.8)	30 (1.2)	494 (3.3)	21 (0.9)	506 (4.4)	37 (1.5)	522 (3.8)
England	6 (0.6)	431 (7.7)	13 (1.0)	463 (5.2)	27 (1.3)	495 (4.0)	22 (0.8)	518 (5.1)	32 (1.5)	540 (4.3)
France	5 (0.5)	511 (9.1)	17 (1.0)	520 (3.8)	36 (1.1)	536 (3.7)	21 (1.0)	559 (4.8)	20 (1.2)	547 (4.7)
Germany	8 (0.8)	447 (6.4)	14 (1.1)	464 (4.5)	26 (1.0)	499 (4.4)	19 (0.9)	532 (5.8)	33 (1.7)	542 (5.4)
Greece	5 (0.4)	450 (5.7)	22 (0.9)	454 (3.3)	43 (0.9)	485 (3.4)	18 (0.7)	509 (5.8)	12 (0.7)	519 (5.8)
Hong Kong	21 (1.2)	559 (9.4)	29 (1.0)	594 (5.9)	29 (0.9)	599 (7.4)	10 (0.7)	602 (7.8)	10 (0.9)	606 (9.2)
Hungary	4 (0.6)	455 (10.7)	8 (0.7)	479 (6.1)	25 (1.0)	517 (4.2)	21 (1.0)	545 (4.1)	42 (1.4)	569 (3.8)
Iceland	1 (0.2)	~ ~	5 (0.8)	465 (9.6)	29 (1.4)	477 (4.9)	28 (1.2)	486 (5.7)	37 (1.7)	501 (6.6)
Iran, Islamic Rep.	37 (1.8)	415 (2.9)	32 (0.9)	432 (2.3)	17 (0.9)	438 (3.3)	6 (0.5)	437 (6.8)	7 (0.7)	452 (5.3)
Ireland	7 (0.6)	468 (7.6)	16 (0.8)	491 (5.9)	34 (1.0)	530 (5.0)	21 (0.7)	550 (5.1)	22 (1.2)	555 (6.3)
Israel	4 (0.6)	482 (14.7)	13 (1.6)	498 (7.7)	31 (1.9)	514 (7.1)	26 (1.4)	539 (8.0)	25 (2.0)	542 (7.6)
Japan	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Korea	10 (0.6)	535 (6.1)	12 (0.8)	560 (6.4)	33 (0.9)	599 (3.6)	23 (0.8)	634 (3.6)	21 (0.9)	652 (4.1)
Kuwait	22 (1.4)	382 (3.2)	27 (1.5)	389 (3.4)	28 (1.6)	400 (3.9)	10 (1.0)	404 (5.4)	13 (0.9)	402 (4.7)
Latvia (LSS)	1 (0.3)	~ ~	4 (0.6)	448 (7.9)	17 (1.0)	471 (4.3)	21 (1.1)	484 (5.0)	57 (1.4)	509 (3.5)
Lithuania	3 (0.4)	415 (7.1)	17 (0.9)	442 (4.5)	35 (1.2)	470 (4.1)	21 (0.9)	496 (4.6)	24 (1.1)	507 (5.2)
Netherlands	8 (1.0)	488 (10.7)	16 (1.3)	507 (10.1)	34 (1.3)	538 (7.3)	19 (0.9)	558 (7.7)	22 (1.7)	577 (7.4)
New Zealand	3 (0.4)	441 (8.2)	7 (0.6)	452 (6.5)	24 (0.8)	488 (4.7)	25 (0.7)	516 (4.8)	41 (1.4)	531 (5.2)
Norway	2 (0.3)	~ ~	6 (0.4)	467 (5.2)	25 (0.9)	483 (3.0)	22 (0.7)	504 (3.2)	45 (1.2)	524 (3.1)
Portugal	10 (0.8)	428 (2.9)	26 (1.3)	443 (2.7)	32 (1.0)	454 (2.6)	15 (0.8)	472 (3.4)	17 (1.4)	475 (4.3)
Romania	24 (1.3)	459 (7.0)	22 (1.3)	466 (5.2)	19 (1.0)	476 (4.8)	11 (0.7)	498 (5.5)	24 (1.7)	523 (5.4)
Russian Federation	2 (0.3)	~ ~	11 (0.8)	495 (10.6)	36 (1.3)	523 (5.2)	24 (0.8)	550 (4.4)	26 (1.3)	562 (4.8)
Scotland	11 (1.2)	441 (4.8)	17 (1.1)	468 (4.7)	28 (1.0)	490 (4.5)	19 (1.0)	525 (5.9)	25 (2.0)	540 (8.0)
Singapore	11 (0.8)	611 (4.8)	22 (0.9)	622 (5.5)	41 (0.8)	648 (4.8)	14 (0.7)	665 (6.8)	12 (1.0)	674 (6.1)
Slovak Republic	2 (0.3)	~ ~	11 (0.6)	497 (6.8)	45 (1.1)	541 (3.2)	23 (0.9)	562 (4.3)	18 (1.0)	581 (5.9)
Slovenia	2 (0.4)	~ ~	15 (0.9)	500 (4.8)	38 (1.2)	532 (3.5)	22 (0.9)	560 (4.7)	22 (1.1)	571 (4.4)
Spain	4 (0.4)	443 (6.1)	18 (1.1)	460 (3.1)	33 (1.0)	482 (2.6)	20 (0.8)	498 (3.2)	26 (1.2)	513 (3.0)
Sweden	3 (0.3)	468 (8.3)	8 (0.7)	464 (5.0)	24 (1.0)	503 (4.3)	24 (0.8)	524 (3.3)	41 (1.5)	541 (3.5)
Switzerland	8 (1.0)	480 (6.9)	16 (0.9)	511 (4.7)	30 (1.0)	542 (3.1)	20 (0.9)	568 (3.7)	26 (1.2)	579 (4.7)
Thailand	19 (1.2)	507 (4.8)	30 (1.0)	514 (5.1)	33 (1.2)	528 (6.5)	9 (0.6)	537 (8.1)	9 (1.0)	552 (9.2)
United States	8 (0.8)	435 (4.5)	13 (0.8)	462 (5.2)	28 (0.9)	491 (3.5)	21 (0.6)	517 (5.2)	31 (1.5)	531 (5.1)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

achievement. Although the main purpose of the question was to gain some information about the relative importance of academic pursuits in the students' home environments rather than to determine the actual number of books in students' homes, there was a substantial amount of variation from country to country in eighth-grade students' reports about the number of books in their homes. In Colombia, Hong Kong, Iran, Kuwait, Romania, and Thailand, 40% or more of the students reported 25 or fewer books in the home. Conversely, 40% or more of the students in Australia, Hungary, Latvia (LSS), New Zealand, Norway, and Sweden reported more than 200 books in their homes.

Information about their parents' educational levels was gathered by asking students to indicate the highest level of education completed by their fathers and mothers. Table 4.3 presents the relationship between eighth-grade students' mathematics achievement and their reports of the highest level of education of either parent. Results are presented at three educational levels: finished university, finished upper secondary school but not university, and finished primary school but not upper secondary school. These three educational levels are based on internationally-defined categories, which may not be strictly comparable across countries due to differences in national education systems. Although the majority of countries translated and defined the educational categories used in their questionnaires to be comparable to the internationally-defined levels, some countries used modified response options to conform to their national education systems. Also, for a few countries, the percentages of students responding to this question fell below 85%. When this happened, the percentages shown in the table are annotated with an "r" for a response rate of 70% to 84% or an "s" if the response rate was from 50% to 69%.

Despite the different educational approaches, structures, and organizations across the TIMSS countries, it is clear from the data in Table 4.3 that parents' education is positively related to students' mathematics achievement. In every country, the pattern was for those eighth-grade students whose parents had more education to also be those who had higher achievement in mathematics. Once again, the purpose of this question was not to ascertain precisely the educational levels of students' parents, but to gain further understanding about the relative importance of schooling in their home environments. As indicated by the results, there was variation among countries in the percentages of students reporting that they did not know their parents' educational levels, as well as in the percentages of students reporting that their parents had completed successively higher educational levels. For example, in Canada, Israel, Lithuania, the Russian Federation, and the United States, more than 30% of the students reported that at least one of their parents had finished university, and only relatively small percentages (fewer than 12%) reported that they did not know the educational levels of their parents. In contrast, almost all students (90% or more) in Hong Kong, Iran, Kuwait, Portugal, and Thailand also reported knowing their parents' educational levels, but for these countries, fewer than 10% of students reported that either parent had finished university.

Table 4.3

Students' Reports on the Highest Level of Education of Either Parent[1] Mathematics - Upper Grade (Eighth Grade*)

Country	Finished University[2]		Finished Upper Secondary School But Not University[3]		Finished Primary School But Not Upper Secondary School[4]		Do Not Know	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	28 (1.4)	572 (4.4)	37 (0.9)	528 (4.4)	24 (0.9)	510 (3.6)	11 (0.6)	494 (4.9)
Austria	10 (0.7)	574 (7.2)	70 (1.1)	547 (3.7)	8 (0.9)	496 (7.4)	12 (0.9)	513 (6.1)
Belgium (Fl)	20 (1.6)	599 (6.0)	34 (1.3)	572 (5.3)	21 (2.4)	538 (10.3)	25 (1.4)	548 (5.9)
Belgium (Fr)	27 (1.6)	557 (3.9)	34 (1.3)	537 (3.9)	11 (1.3)	491 (6.2)	27 (1.6)	501 (7.4)
Canada	37 (1.3)	544 (3.4)	39 (1.2)	526 (2.9)	13 (0.9)	510 (5.1)	10 (0.5)	504 (4.2)
Colombia	15 (1.6)	410 (8.2)	28 (1.6)	396 (4.3)	47 (2.3)	378 (4.1)	10 (0.9)	371 (6.8)
Cyprus	r 15 (0.9)	521 (4.8)	29 (1.1)	502 (4.0)	52 (1.4)	455 (2.9)	4 (0.5)	454 (8.8)
Czech Republic	21 (1.7)	604 (7.5)	47 (1.5)	571 (4.9)	25 (1.5)	532 (4.1)	7 (0.8)	516 (7.8)
Denmark	13 (1.0)	528 (5.5)	46 (1.5)	512 (3.5)	8 (0.7)	488 (8.0)	33 (1.7)	498 (4.0)
England	- -	- -	- -	- -	- -	- -	- -	- -
France	r 13 (1.2)	576 (5.8)	36 (1.3)	549 (3.6)	19 (1.2)	530 (4.1)	31 (1.3)	529 (3.8)
Germany	11 (1.0)	553 (8.5)	32 (1.3)	526 (5.0)	38 (1.6)	504 (4.2)	19 (1.3)	488 (6.7)
Greece	18 (1.1)	537 (6.3)	39 (1.3)	492 (4.5)	40 (1.8)	462 (2.9)	3 (0.3)	457 (8.1)
Hong Kong	7 (1.0)	638 (8.6)	30 (1.2)	607 (6.6)	55 (1.8)	584 (5.9)	7 (0.7)	554 (12.6)
Hungary	r 24 (1.8)	594 (4.9)	66 (1.7)	539 (3.2)	11 (0.9)	492 (6.0)	- -	- -
Iceland	25 (2.8)	505 (7.0)	44 (2.0)	495 (4.7)	15 (1.4)	467 (6.8)	15 (1.0)	472 (6.5)
Iran, Islamic Rep.	r 3 (0.6)	468 (7.1)	21 (1.8)	447 (2.5)	68 (2.2)	426 (2.5)	7 (1.0)	424 (5.6)
Ireland	17 (1.3)	564 (7.6)	46 (1.0)	535 (4.7)	26 (1.2)	510 (5.7)	10 (0.7)	499 (6.6)
Israel	37 (2.5)	552 (7.8)	45 (2.2)	518 (5.8)	10 (1.3)	486 (5.9)	8 (0.9)	506 (8.5)
Japan	- -	- -	- -	- -	- -	- -	- -	- -
Korea	22 (1.3)	654 (5.1)	47 (1.3)	607 (2.8)	26 (1.1)	575 (4.2)	5 (0.5)	573 (9.3)
Kuwait	s 3 (1.2)	429 (11.6)	3 (0.9)	387 (13.2)	92 (2.1)	390 (2.9)	1 (0.7)	~ ~
Latvia (LSS)	r 27 (1.5)	528 (5.5)	49 (1.4)	493 (3.7)	13 (1.0)	470 (6.2)	11 (1.0)	473 (6.4)
Lithuania	s 37 (1.6)	508 (4.4)	44 (1.6)	474 (4.1)	7 (1.0)	449 (6.3)	12 (1.2)	472 (6.4)
Netherlands	12 (1.4)	570 (10.6)	55 (1.8)	549 (7.7)	10 (0.7)	524 (9.2)	23 (1.4)	522 (7.8)
New Zealand	25 (1.3)	543 (6.0)	38 (1.1)	504 (4.4)	15 (0.8)	491 (5.7)	21 (1.1)	494 (5.4)
Norway	25 (1.2)	524 (4.5)	38 (1.1)	505 (3.1)	9 (0.6)	487 (4.6)	27 (1.2)	495 (3.2)
Portugal	9 (1.2)	494 (4.6)	13 (1.0)	473 (4.0)	73 (2.0)	447 (2.1)	5 (0.4)	452 (5.8)
Romania	10 (1.3)	517 (8.7)	47 (1.5)	497 (4.9)	33 (1.9)	467 (7.2)	10 (0.9)	460 (6.5)
Russian Federation	34 (1.8)	565 (4.9)	54 (1.6)	526 (6.4)	5 (0.5)	484 (8.0)	6 (0.8)	519 (10.8)
Scotland	14 (1.4)	559 (8.4)	33 (1.4)	499 (5.3)	14 (0.8)	485 (5.5)	39 (1.3)	487 (5.6)
Singapore	8 (1.0)	692 (7.5)	69 (1.0)	645 (5.0)	23 (1.2)	623 (4.9)	- -	- -
Slovak Republic	20 (1.4)	588 (5.4)	50 (1.1)	551 (3.2)	23 (1.2)	517 (4.5)	6 (0.5)	521 (7.5)
Slovenia	19 (1.1)	583 (4.4)	59 (1.4)	542 (3.4)	18 (1.3)	503 (4.6)	4 (0.4)	522 (9.0)
Spain	15 (1.2)	517 (3.6)	21 (0.9)	502 (3.3)	54 (1.8)	479 (2.3)	10 (0.8)	478 (3.5)
Sweden	22 (1.2)	544 (3.9)	34 (1.1)	524 (3.4)	9 (0.6)	494 (4.6)	35 (1.1)	511 (3.4)
Switzerland	11 (0.8)	588 (5.4)	61 (1.3)	552 (2.6)	13 (0.9)	520 (5.1)	15 (1.0)	534 (4.7)
Thailand	9 (1.4)	571 (9.5)	14 (1.4)	543 (8.9)	73 (2.6)	513 (4.4)	3 (0.5)	524 (12.3)
United States	33 (1.4)	527 (5.9)	54 (1.3)	494 (4.0)	7 (0.8)	455 (4.8)	5 (0.4)	489 (8.5)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

[1] The response categories were defined by each country to conform to their own educational system and may not be strictly comparable across countries. See Figure 4.1 for country modifications to the definitions of educational levels. Also, no response category was provided for students whose parents had no formal education or did not finish primary school, except in France where a small percentage of students in this category are included in the missing responses.

[2] In most countries, defined as completion of at least a 4-year degree program at a university or an equivalent institute of higher education.

[3] Finished upper secondary school with or without some tertiary education not equivalent to a university degree. In most countries, finished secondary corresponds to completion of an upper-secondary track terminating after 11 to 13 years of schooling.

[4] Finished primary school or some secondary school not equivalent to completion of upper secondary.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates a 70-84% student response rate. An "s" indicates a 50-69% student response rate.

Data for Singapore not obtained from students; entered at ministry level.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 4.1 Country Modifications to the Definitions of Educational Levels for Parents' Highest Level of Education[1]

Finished Primary School But Not Upper Secondary School

Internationally-Defined Levels: *Finished Primary School or*
Finished Some Secondary School

Countries with Modified Nationally-Defined Levels:

Austria:	*Compulsory (Pflichtschulabschluß; 9 grades)*
Denmark:	*Basic school (Folkeskolen, Realeksamen; 9 or 10 grades)*
France:	*Lower Secondary (Collége, CAP)*
Germany:	*Lower secondary (Hauptschulabschluß; 9 or 10 grades) or* *Medium secondary (Fachoberschulreife, Realschulabschluß or Polytechnische Oberschule: 10 grades)*
Hungary:	*Some or all of general school (8 grades)*
Norway:	*Compulsory (9 grades) or some upper secondary*
Scotland:	*Some secondary school*
Singapore:	*Primary school*
Sweden:	*Compulsory (9 grades) or started upper secondary*
Switzerland:	*Compulsory (9 grades)*

Finished Upper Secondary School[2] But Not University

Internationally-Defined Levels: *Finished Secondary School or*
Some Vocational/Technical Education After Secondary School or
Some University

Countries with Modified Nationally-Defined Levels:

Austria:	*Upper-secondary tracks: apprenticeship (Berufsschul-/Lehrabschluß), medium vocational (Handelsschule, Fachschule), higher vocational (HAK, HTL, etc.), or higher academic (Gymnasium, Realgymnasium)*
Cyprus:	*Upper-secondary tracks: academic or vocational/technical or* *Post-Secondary: Finished college*
Denmark:	*Upper-secondary tracks: academic or general/vocational (gymnasium, hf, htx, hhx) vocational training (erhvervsfaglig uddannelse)* *Post-Secondary: Medium-cycle higher education (mellemlang uddannselse)*
France:	*Upper secondary tracks: BEP (11 grades) or baccalauréat (général, technologique or professionnel; 12 or 13 grades)* *Post-Secondary: 2 or 3 years study after baccalauréat (BTS, DUT, Licence)*
Germany:	*Upper-secondary tracks: general/academic or apprenticeship/vocational training (Lehrabschluß, Berufsfachschule)* *Post-Secondary: Higher vocational schools (Fachhochschulabschluß)*
Hungary:	*Upper-secondary tracks: apprenticeship (general + 3 years) or final exam in secondary (general + 4 years)*
Sweden:	*Upper-secondary tracks: academic or vocational (gymnasieutbildning or yrkesinriktad utbildning)* *Post-Secondary: Less than 3 years of university studies*
Switzerland:	*Upper-secondary tracks: occupational (apprentissage, école professionnelle), academic (gymnase, baccalauréat, maturité cantonale), or teacher training (école normale, formation d'enseignant)* *Post-Secondary: Applied science university (haute école professionnelle ou commerciale)*

Finished University

Internationally-Defined Level: *Finished University*

Countries with Modified Nationally-Defined Levels:

Austria:	*University (master's degree)*	New Zealand:	*University or Teachers' College*
Canada:	*University or college*	Norway:	*University or college*
Cyprus:	*University degree or post-graduate studies*	Portugal:	*University or polytechnic*
France:	*4 years of study after baccalauréat*	Sweden:	*3 years university studies or more*
Germany:	*University, Technical University or Pedagogical Institute*	Switzerland:	*University or insitute of technology*
Hungary:	*University or college diploma*	United States:	*Bachelor's degree at college or university*

[1] Educational levels were translated and defined in most countries to be comparable to the internationally-defined levels. Countries that used modified response options to conform to their national education systems are indicated to aid in the interpretation of the reporting categories presented in Table 4.3.

[2] Upper-secondary corresponds to ISCED level 3 tracks terminating after 11 to 13 years in most countries. (Education at a Glance, OECD, 1995)

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95

Figure 4.1 shows the definitions of the educational categories used by TIMSS and the modifications made to them by some countries. In several countries, the finished primary school but not upper secondary school category included only a single level corresponding to finishing compulsory education (8 to 10 grades) and did not include finishing only primary school. In addition, in Germany, the completion of medium secondary education was considered part of this category, while in Austria, which has an educational system similar to Germany's, the medium-level vocational education was included in the second category reporting upper-secondary education.

The second reporting category (finished upper secondary school but not university) was complicated because, in many countries, particularly in Europe, there are several upper-secondary tracks leading to university or other tertiary institutions as well as vocational/apprenticeship programs. In most countries, finishing upper secondary means completion of 11 to 13 years of education. In some systems, however, the general secondary education may be completed after 9 or 10 years, followed by 2 to 4 years of full- or part-time vocational/apprenticeship training that may be either included as part of the secondary educational system or considered as post-secondary. All of the upper-secondary tracks and any upper-secondary or post-secondary vocational education programs included as response options are combined in the second reporting category.

Several countries also differed in their interpretation of what is included in the category of finished university. For example, degrees obtained from technical institutes and other non-university institutions of higher education are considered equivalent to a university degree in some countries but not in others. Completion of a degree at one of these institutions, therefore, may have been included in either the finished university or the finished upper secondary school but not university categories. In countries such as Canada, New Zealand, Portugal, and the United States, the finished university category includes the completion of the equivalent of a bachelor's degree at either a university, college, or polytechnic, while in Austria and France, this category corresponds to the equivalent of a master's degree received at a university.

WHAT ARE THE ACADEMIC EXPECTATIONS OF STUDENTS, THEIR FAMILIES, AND THEIR FRIENDS?

Tables 4.4, 4.5, and 4.6 present eighth-grade students' reports about how they themselves, their mothers, and their friends feel about the importance of doing well in various academic and non-academic activities. The first three questions asked about the degree of agreement with the importance of doing well in the academic subjects of mathematics, science, and language, respectively. In almost every country, nearly all eighth-graders agreed or strongly agreed that it was important to do well in mathematics. The percentages were in the high 90s for many countries and exceeded 90% in all countries except one, and that was Romania, with 88% agreement. Similarly, approximately the same high percentages of students were in agreement with the importance of doing well in language. In many countries, somewhat fewer eighth-grade students agreed with the importance of doing well in science. Still, the percentages were relatively high, ranging from more than 90% agreement in a number of countries to a low of 68% in Switzerland and 72% in Germany.

For the most part, eighth-grade students indicated that their mothers' opinions about the importance of these academic activities corresponded very closely to their own feelings. In contrast, however, students reported that their friends were not in as much agreement about the importance of academic success. Although students' friends purportedly were in general agreement with the importance of doing well in mathematics, the percentages were generally in the 80s rather than the 90s. According to students, their friends were in the lowest degree of agreement about doing well in mathematics in Germany and Sweden (70% for both countries).

As with the students' reports about their own feelings and those of their mothers, students indicated a close alignment in their friends' degree of agreement about the importance of academic success in mathematics and that in language. Apparently, even though the relative importance varies from group to group, students, their mothers, and their friends find it very nearly equally important to do well in mathematics and language. According to students in some countries, however, their friends do not have nearly the same positive feeling about the importance of doing well in science. Countries where fewer than two-thirds of eighth-graders reported that their friends agreed or strongly agreed it was important to do well in science included Australia (64%), Austria (45%), the Czech Republic (61%), France (53%), Germany (35%), Hungary (66%), Iceland (65%), Ireland (59%), Israel (56%), Latvia (LSS) (53%), Lithuania (55%), New Zealand (66%), the Slovak Republic (60%), Slovenia (56%), Sweden (61%), and Switzerland (40%).

For purposes of comparison, eighth-grade students also were asked about the importance of two non-academic activities – having time to have fun and being good at sports. In most countries, very high percentages of the students (more than 95%) felt it was important to have time to have fun. The percentages in agreement were similar to those agreeing that it was important to do well in mathematics and language. Generally, there was less agreement about the importance of being good at sports which was rather similar to the level of agreement about the importance of doing well in science.

It needs to be emphasized, however, that the relative rankings given to the five activities by students varied from country to country.

In nearly all countries, 80% or more of the eighth-grade students reported that their mothers agreed that it was important to have time to have fun. The exceptions were Hong Kong (74%), Iran (79%), Korea (58%), Kuwait (63%), and Singapore (79%), where students reported from 8% to 29% lower agreement for their mothers than for themselves. According to students, their mothers give a moderate to high degree of support to the importance of being good at sports. In nearly all countries, the percentages of students' reporting such agreement were in the 70s, 80s, and 90s, except in Austria (56%), Germany (48%), Kuwait (69%), the Netherlands (63%), and Switzerland (59%).

As might be anticipated, students reported that most of their friends agreed that it was important to have fun – more than 90% in all countries except Iran (87%), Korea (88%), Kuwait (77%), and Romania (86%). Internationally, eighth-graders reported that their friends generally were in moderate agreement that it was important to do well in sports. The percentages of their friends' agreement as reported by students ranged from a low of 64% in Germany to a high of 96% in Colombia.

Table 4.4

Students' Reports on Whether They Agree or Strongly Agree That It Is Important to Do Various Activities - Mathematics - Upper Grade (Eighth Grade*)

Country	Percent of Students				
	Do Well in Mathematics	**Do Well in Science**	**Do Well in Language**	**Have Time to Have Fun**	**Be Good at Sports**
Australia	96 (0.4)	89 (0.6)	95 (0.4)	98 (0.2)	85 (0.6)
Austria	94 (0.5)	82 (1.2)	93 (0.6)	98 (0.3)	82 (0.9)
Belgium (Fl)	98 (0.3)	93 (0.6)	98 (0.4)	98 (0.3)	80 (1.0)
Belgium (Fr)	98 (0.3)	94 (0.7)	98 (0.3)	98 (0.4)	87 (0.8)
Canada	98 (0.2)	94 (0.7)	97 (0.3)	99 (0.2)	86 (0.6)
Colombia	99 (0.2)	99 (0.2)	99 (0.2)	98 (0.3)	97 (0.3)
Cyprus	94 (0.5)	86 (1.0)	94 (0.6)	94 (0.5)	85 (1.0)
Czech Republic	98 (0.5)	88 (1.0)	98 (0.3)	98 (0.3)	84 (0.9)
Denmark	97 (0.4)	87 (1.0)	97 (0.4)	99 (0.3)	83 (0.8)
England	99 (0.2)	96 (0.5)	99 (0.3)	99 (0.3)	80 (1.1)
France	97 (0.4)	83 (1.2)	97 (0.5)	97 (0.4)	80 (0.8)
Germany	93 (0.6)	72 (1.0)	91 (0.6)	97 (0.4)	72 (1.1)
Greece	96 (0.4)	93 (0.5)	96 (0.4)	96 (0.4)	91 (0.6)
Hong Kong	96 (0.5)	90 (0.9)	96 (0.5)	94 (0.5)	83 (0.9)
Hungary	95 (0.5)	86 (0.8)	95 (0.5)	96 (0.5)	78 (0.9)
Iceland	97 (1.0)	90 (1.2)	97 (1.0)	98 (0.4)	90 (1.6)
Iran, Islamic Rep.	97 (0.4)	98 (0.4)	96 (0.6)	87 (1.1)	95 (0.7)
Ireland	97 (0.3)	86 (1.1)	96 (0.4)	99 (0.2)	85 (0.8)
Israel	98 (0.5)	85 (1.0)	89 (1.5)	98 (0.5)	84 (1.3)
Japan	92 (0.4)	87 (0.6)	91 (0.5)	99 (0.1)	83 (0.7)
Korea	94 (0.5)	91 (0.6)	93 (0.6)	87 (0.8)	86 (0.8)
Kuwait	96 (0.6)	96 (0.6)	96 (0.5)	85 (2.0)	81 (1.2)
Latvia (LSS)	97 (0.4)	84 (1.0)	97 (0.3)	97 (0.4)	87 (0.8)
Lithuania	93 (0.6)	78 (1.1)	96 (0.4)	94 (0.6)	93 (0.5)
Netherlands	97 (0.6)	95 (0.7)	99 (0.3)	98 (0.6)	78 (1.2)
New Zealand	97 (0.3)	92 (0.6)	96 (0.5)	99 (0.3)	86 (0.7)
Norway	96 (0.5)	92 (0.6)	96 (0.5)	99 (0.1)	79 (0.9)
Portugal	97 (0.3)	97 (0.3)	99 (0.2)	93 (0.5)	94 (0.5)
Romania	88 (0.8)	86 (0.8)	88 (0.8)	86 (1.0)	80 (1.1)
Russian Federation	97 (0.4)	95 (0.6)	97 (0.5)	98 (0.4)	88 (0.9)
Scotland	98 (0.4)	92 (0.7)	98 (0.3)	98 (0.3)	82 (0.9)
Singapore	99 (0.2)	99 (0.2)	100 (0.1)	96 (0.3)	89 (0.6)
Slovak Republic	96 (0.4)	86 (0.8)	96 (0.4)	98 (0.2)	91 (0.5)
Slovenia	96 (0.5)	86 (0.9)	96 (0.4)	95 (0.5)	87 (0.7)
Spain	99 (0.2)	99 (0.2)	99 (0.2)	99 (0.1)	95 (0.3)
Sweden	92 (0.6)	84 (0.8)	90 (0.6)	99 (0.2)	84 (0.7)
Switzerland	96 (0.4)	68 (1.1)	94 (0.4)	95 (0.6)	78 (0.9)
Thailand	93 (0.5)	94 (0.5)	96 (0.4)	95 (0.3)	91 (0.5)
United States	97 (0.3)	96 (0.5)	96 (0.3)	99 (0.2)	88 (0.6)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 4.5

Students' Reports on Whether Their Mothers Agree or Strongly Agree That It Is Important to Do Various Activities - Mathematics - Upper Grade (Eighth Grade*)

Country	Percent of Students				
	Do Well in Mathematics	Do Well in Science	Do Well in Language	Have Time to Have Fun	Be Good at Sports
Australia	98 (0.2)	94 (0.4)	98 (0.2)	94 (0.4)	83 (0.7)
Austria	96 (0.4)	81 (1.0)	95 (0.5)	90 (0.7)	56 (1.1)
Belgium (Fl)	97 (0.4)	93 (0.8)	98 (0.4)	94 (0.5)	73 (1.2)
Belgium (Fr)	99 (0.3)	98 (0.3)	99 (0.3)	95 (0.6)	85 (0.7)
Canada	99 (0.1)	98 (0.3)	99 (0.1)	96 (0.4)	83 (0.7)
Colombia	99 (0.4)	99 (0.3)	99 (0.2)	93 (0.6)	94 (1.0)
Cyprus	95 (0.4)	89 (0.8)	95 (0.5)	91 (0.6)	80 (0.8)
Czech Republic	99 (0.2)	93 (0.8)	98 (0.3)	90 (0.7)	74 (1.1)
Denmark	99 (0.3)	95 (0.6)	99 (0.3)	98 (0.3)	81 (1.0)
England	99 (0.3)	96 (0.5)	99 (0.3)	94 (0.6)	74 (1.2)
France	98 (0.3)	88 (0.9)	99 (0.3)	91 (0.7)	74 (1.0)
Germany	94 (0.8)	71 (1.4)	93 (0.7)	88 (0.7)	48 (1.2)
Greece	96 (0.3)	94 (0.5)	96 (0.4)	89 (0.6)	83 (0.7)
Hong Kong	93 (0.6)	86 (0.7)	93 (0.6)	74 (0.9)	71 (1.3)
Hungary	96 (0.4)	85 (0.8)	96 (0.4)	96 (0.4)	73 (1.1)
Iceland	97 (0.8)	95 (1.3)	98 (0.5)	95 (0.7)	87 (1.6)
Iran, Islamic Rep.	96 (0.5)	96 (0.5)	95 (0.5)	79 (1.8)	90 (1.5)
Ireland	98 (0.3)	89 (1.0)	98 (0.2)	94 (0.5)	83 (0.8)
Israel	99 (0.4)	89 (0.9)	93 (0.6)	95 (0.7)	79 (1.4)
Japan	- -	- -	- -	- -	- -
Korea	96 (0.4)	92 (0.5)	94 (0.5)	58 (1.1)	72 (0.9)
Kuwait	91 (1.0)	r 91 (0.9)	r 91 (0.8)	r 63 (2.2)	r 69 (2.0)
Latvia (LSS)	97 (0.4)	85 (1.1)	97 (0.5)	90 (0.8)	82 (0.9)
Lithuania	91 (0.6)	77 (1.1)	95 (0.5)	86 (0.8)	87 (0.9)
Netherlands	96 (0.5)	94 (0.7)	97 (0.4)	96 (0.4)	63 (1.4)
New Zealand	98 (0.3)	95 (0.4)	97 (0.3)	95 (0.5)	86 (0.8)
Norway	97 (0.4)	95 (0.5)	97 (0.4)	97 (0.3)	71 (1.1)
Portugal	96 (0.4)	98 (0.3)	98 (0.3)	87 (0.7)	91 (0.6)
Romania	93 (0.5)	94 (0.6)	90 (0.7)	83 (1.0)	76 (1.0)
Russian Federation	96 (0.3)	95 (0.4)	97 (0.4)	92 (0.6)	84 (0.7)
Scotland	98 (0.3)	93 (0.6)	99 (0.2)	94 (0.5)	77 (1.0)
Singapore	99 (0.2)	99 (0.2)	99 (0.1)	79 (0.8)	84 (0.8)
Slovak Republic	99 (0.2)	94 (0.5)	99 (0.2)	95 (0.4)	88 (0.6)
Slovenia	91 (0.7)	85 (0.7)	92 (0.6)	88 (0.7)	81 (0.9)
Spain	99 (0.2)	99 (0.2)	99 (0.2)	96 (0.4)	93 (0.5)
Sweden	96 (0.4)	92 (0.5)	95 (0.4)	97 (0.3)	83 (0.7)
Switzerland	96 (0.3)	69 (1.0)	95 (0.4)	83 (0.9)	59 (1.1)
Thailand	94 (0.5)	95 (0.4)	96 (0.4)	84 (0.9)	90 (0.5)
United States	98 (0.2)	97 (0.2)	98 (0.2)	93 (0.4)	81 (0.8)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Data are reported as percent of students.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

A dash (-) indicates data are not available.

An "r" indicates a 70-84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 4.6

Students' Reports on Whether Their Friends Agree or Strongly Agree That It Is Important to Do Various Activities - Mathematics - Upper Grade (Eighth Grade*)

Country	Percent of Students				
	Do Well in Mathematics	Do Well in Science	Do Well in Language	Have Time to Have Fun	Be Good at Sports
Australia	78 (0.8)	64 (1.0)	76 (0.8)	98 (0.2)	83 (0.8)
Austria	77 (1.2)	45 (1.8)	74 (1.1)	97 (0.4)	79 (1.2)
Belgium (Fl)	84 (1.7)	70 (1.6)	83 (1.8)	98 (0.4)	76 (1.5)
Belgium (Fr)	86 (1.1)	78 (1.3)	87 (0.9)	97 (0.4)	84 (1.2)
Canada	80 (0.8)	68 (1.3)	78 (0.8)	99 (0.2)	87 (0.6)
Colombia	95 (0.5)	93 (0.6)	95 (0.5)	97 (0.4)	96 (0.4)
Cyprus	85 (0.8)	71 (1.1)	85 (0.9)	91 (0.6)	82 (1.0)
Czech Republic	84 (1.3)	61 (1.5)	84 (1.2)	98 (0.3)	82 (1.1)
Denmark	94 (0.6)	82 (1.0)	95 (0.6)	99 (0.2)	92 (0.7)
England	88 (0.9)	80 (1.1)	88 (0.9)	99 (0.3)	79 (1.2)
France	85 (1.3)	53 (1.5)	88 (1.1)	97 (0.4)	80 (1.0)
Germany	70 (1.3)	35 (1.4)	68 (1.3)	94 (0.5)	64 (1.3)
Greece	87 (0.7)	82 (0.8)	89 (0.6)	96 (0.3)	85 (0.8)
Hong Kong	86 (0.9)	74 (1.3)	87 (0.9)	93 (0.5)	76 (1.0)
Hungary	81 (0.9)	66 (1.2)	83 (0.8)	94 (0.5)	74 (1.1)
Iceland	85 (1.4)	65 (2.0)	85 (1.1)	98 (0.4)	89 (1.2)
Iran, Islamic Rep.	95 (0.5)	95 (0.9)	93 (0.6)	87 (1.3)	93 (0.9)
Ireland	80 (0.9)	59 (1.4)	78 (0.8)	99 (0.2)	85 (0.7)
Israel	93 (1.1)	56 (2.5)	75 (2.0)	98 (0.5)	79 (1.9)
Japan	90 (0.5)	83 (0.7)	88 (0.6)	99 (0.2)	81 (0.7)
Korea	86 (0.8)	79 (0.9)	81 (0.8)	88 (0.7)	78 (1.0)
Kuwait	90 (0.8)	90 (0.6)	86 (0.9)	77 (2.4)	78 (1.5)
Latvia (LSS)	86 (0.9)	53 (1.3)	87 (1.0)	97 (0.4)	87 (0.8)
Lithuania	83 (0.9)	55 (1.3)	88 (0.9)	95 (0.5)	90 (0.7)
Netherlands	87 (0.9)	82 (1.2)	90 (0.7)	97 (0.6)	66 (1.2)
New Zealand	77 (1.0)	66 (1.2)	76 (1.0)	98 (0.3)	87 (0.8)
Norway	84 (0.8)	72 (1.2)	83 (0.9)	99 (0.2)	83 (1.0)
Portugal	89 (0.7)	88 (0.8)	93 (0.4)	92 (0.6)	94 (0.5)
Romania	87 (0.8)	80 (1.0)	88 (0.8)	86 (1.0)	81 (1.0)
Russian Federation	88 (0.8)	81 (0.8)	88 (0.8)	97 (0.4)	84 (0.8)
Scotland	81 (1.2)	70 (1.3)	82 (1.0)	98 (0.3)	84 (0.8)
Singapore	97 (0.4)	96 (0.5)	98 (0.2)	96 (0.3)	86 (0.8)
Slovak Republic	83 (0.7)	60 (1.3)	84 (0.7)	98 (0.2)	92 (0.5)
Slovenia	77 (1.2)	56 (1.6)	78 (1.1)	95 (0.5)	81 (0.9)
Spain	91 (0.6)	89 (0.7)	91 (0.5)	99 (0.2)	94 (0.4)
Sweden	70 (1.2)	61 (1.4)	68 (1.2)	97 (0.3)	75 (0.8)
Switzerland	85 (0.8)	40 (1.4)	82 (1.0)	93 (0.8)	75 (1.1)
Thailand	93 (0.6)	94 (0.5)	95 (0.4)	95 (0.4)	91 (0.4)
United States	75 (1.0)	69 (1.2)	73 (0.9)	98 (0.2)	90 (0.7)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Data are reported as percent of students.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A 3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

How Do Students Spend Their Out-of-School Time During the School Week?

Even though education may be thought to be the dominant activity of school-aged children, young people actually spend much more of their time outside of school. Some of this out-of-school time is spent at furthering academic development – for example, in studying or doing homework in school subjects. Table 4.7 presents eighth-grade students' reports about the average number of hours per day they spend studying or doing homework in mathematics, science, and other subjects. Students in many countries reported spending roughly an hour per day studying mathematics. Eighth-graders in the Czech Republic, Denmark, Germany, the Netherlands, and Scotland were at the lower end of the range, reporting an average of about one-half hour per day (.5 to .6 of an hour). Those in Iran and Romania were at the top end, reporting about two hours mathematics homework per day (2.0 and 1.8 hours, respectively). On average, students in nearly all countries reported spending somewhat less time per day studying science.

Participating countries showed some variation in the amount of time students spent doing homework each day across all school subjects. The most common response about the amount of homework done, reported by eighth-graders in about half the countries, was an average of two to three hours per day, but there was a range. Students in Iran, Kuwait, and Romania reported spending the most time on homework, more than five hours per day. Students in the Czech Republic, Denmark, and Scotland reported spending the least amount of time per day on homework, less than two hours.

The students also were asked about a variety of other ways they could spend their time out of school. Eighth-graders were asked about watching television, playing computer games, playing or talking with friends, doing jobs at home, playing sports, and reading books for enjoyment. Their reports about the amount of time spent daily in each of these activities are shown in Table 4.8. Granted, some television programming and some computer games are targeted at developing children's academic abilities, and leisure reading also can be related to higher academic achievement. Still, much fare on television is not educationally related, and eighth-grade students in many countries reported spending nearly as much time each day watching television – an average of two to three hours per day – as they did doing homework. Eighth-graders in many countries also appear to spend several hours per day playing or talking with friends, and nearly two hours playing sports. The time spent on leisure activities is not additive, because students often do these activities simultaneously (e.g., talk with friends and watch television). Nevertheless, it does appear that in most countries at least as much time is spent in these largely non-academic activities as in studying and doing homework, and probably more time.

Table 4.9 shows the relationship between time spent doing homework in all subjects and students' average mathematics achievement. The relationship was curvilinear in many countries, with the highest achievement being associated with a moderate amount of homework per day (one to three hours). This pattern suggests that, compared to their higher-achieving counterparts, the lower-performing students may do less homework, either because they do not do it or because their teachers do not assign it, or more

Table 4.7

Students' Reports on How They Spend Their Daily Out-of School Study Time[1] Mathematics - Upper Grade (Eighth Grade*)

Country	Average Hours Each Day Studying Mathematics or Doing Mathematics Homework After School	Average Hours Each Day Studying Science or Doing Science Homework After School	Average Hours Each Day Studying or Doing Homework in Other School Subjects	Total Hours Each Day on Average
Australia	0.7 (0.02)	0.5 (0.01)	0.9 (0.02)	2.0 (0.04)
Austria	0.8 (0.02)	0.7 (0.03)	0.8 (0.02)	2.4 (0.07)
Belgium (Fl)	1.1 (0.03)	0.8 (0.02)	1.5 (0.03)	3.4 (0.07)
Belgium (Fr)	1.0 (0.02)	0.8 (0.02)	1.2 (0.03)	3.0 (0.07)
Canada	0.7 (0.02)	0.6 (0.02)	0.9 (0.03)	2.2 (0.07)
Colombia	1.3 (0.06)	1.2 (0.06)	2.0 (0.07)	4.6 (0.15)
Cyprus	1.2 (0.02)	0.9 (0.02)	1.5 (0.03)	3.6 (0.06)
Czech Republic	0.6 (0.02)	0.6 (0.02)	0.6 (0.02)	1.8 (0.05)
Denmark	0.5 (0.02)	0.3 (0.02)	0.5 (0.02)	1.4 (0.05)
England	- -	- -	- -	- -
France	0.9 (0.02)	0.6 (0.01)	1.2 (0.03)	2.7 (0.05)
Germany	0.6 (0.02)	0.6 (0.02)	0.8 (0.02)	2.0 (0.05)
Greece	1.2 (0.03)	1.2 (0.03)	2.0 (0.05)	4.4 (0.08)
Hong Kong	0.9 (0.02)	0.6 (0.02)	1.1 (0.03)	2.5 (0.06)
Hungary	0.8 (0.02)	1.1 (0.02)	1.2 (0.03)	3.1 (0.06)
Iceland	0.9 (0.03)	0.6 (0.03)	0.9 (0.03)	2.4 (0.07)
Iran, Islamic Rep.	2.0 (0.05)	1.9 (0.05)	2.5 (0.05)	6.4 (0.13)
Ireland	0.7 (0.02)	0.6 (0.01)	1.4 (0.03)	2.7 (0.05)
Israel	1.0 (0.04)	0.6 (0.03)	1.2 (0.05)	2.8 (0.10)
Japan	0.8 (0.01)	0.6 (0.01)	1.0 (0.02)	2.3 (0.04)
Korea	0.8 (0.02)	0.6 (0.02)	1.1 (0.02)	2.5 (0.05)
Kuwait	1.6 (0.04)	1.5 (0.05)	2.3 (0.07)	5.3 (0.12)
Latvia (LSS)	0.9 (0.02)	0.6 (0.02)	1.2 (0.03)	2.7 (0.05)
Lithuania	0.8 (0.02)	0.7 (0.02)	1.2 (0.04)	2.7 (0.06)
Netherlands	0.6 (0.01)	0.6 (0.01)	1.0 (0.03)	2.2 (0.04)
New Zealand	0.7 (0.02)	0.6 (0.01)	0.9 (0.02)	2.1 (0.05)
Norway	0.7 (0.02)	0.6 (0.01)	1.0 (0.02)	2.3 (0.04)
Portugal	1.0 (0.02)	0.9 (0.02)	1.1 (0.02)	3.0 (0.05)
Romania	1.8 (0.07)	1.6 (0.06)	1.6 (0.06)	5.0 (0.18)
Russian Federation	0.9 (0.02)	1.0 (0.02)	1.0 (0.02)	2.9 (0.05)
Scotland	0.6 (0.02)	0.5 (0.01)	0.7 (0.02)	1.8 (0.04)
Singapore	1.4 (0.02)	1.3 (0.02)	1.9 (0.03)	4.6 (0.04)
Slovak Republic	0.7 (0.01)	0.8 (0.02)	0.9 (0.02)	2.4 (0.04)
Slovenia	0.9 (0.02)	1.0 (0.02)	0.9 (0.02)	2.9 (0.05)
Spain	1.2 (0.02)	1.0 (0.02)	1.4 (0.03)	3.6 (0.06)
Sweden	0.7 (0.01)	0.7 (0.01)	0.9 (0.02)	2.3 (0.04)
Switzerland	0.9 (0.02)	0.7 (0.01)	1.0 (0.02)	2.7 (0.04)
Thailand	1.2 (0.03)	1.0 (0.02)	1.3 (0.02)	3.5 (0.06)
United States	0.8 (0.02)	0.6 (0.01)	0.9 (0.02)	2.3 (0.04)

[1] Average hours based on: No Time = 0; Less Than 1 Hour = .5; 1-2 Hours = 1.5; 3-5 Hours = 4; More Than 5 Hours = 7.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

A dash (-) indicates data are not available.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 4.8

Students' Reports on How They Spend Their Daily Leisure Time[1]
Mathematics - Upper Grade (Eighth Grade*)

Country	Average Hours Each Day Watching Television or Videos	Average Hours Each Day Playing Computer Games	Average Hours Each Day Playing or Talking with Friends	Average Hours Each Day Doing Jobs at Home	Average Hours Each Day Playing Sports	Average Hours Each Day Reading a Book for Enjoyment
Australia	2.4 (0.05)	0.6 (0.02)	1.4 (0.03)	0.9 (0.02)	1.6 (0.03)	0.6 (0.02)
Austria	1.9 (0.06)	0.6 (0.03)	2.9 (0.08)	0.8 (0.03)	1.9 (0.07)	0.8 (0.03)
Belgium (Fl)	2.0 (0.05)	0.5 (0.06)	1.6 (0.05)	1.1 (0.03)	1.8 (0.07)	0.7 (0.03)
Belgium (Fr)	1.9 (0.08)	0.7 (0.03)	1.7 (0.10)	0.8 (0.03)	1.8 (0.04)	0.8 (0.03)
Canada	2.3 (0.04)	0.5 (0.02)	2.2 (0.05)	1.0 (0.02)	1.9 (0.03)	0.8 (0.02)
Colombia	2.2 (0.07)	r 0.4 (0.06)	1.9 (0.06)	2.3 (0.07)	1.9 (0.06)	0.9 (0.05)
Cyprus	2.3 (0.04)	0.8 (0.03)	1.7 (0.04)	1.0 (0.03)	1.4 (0.04)	0.8 (0.02)
Czech Republic	2.6 (0.05)	0.6 (0.03)	2.9 (0.09)	1.3 (0.04)	1.9 (0.06)	1.0 (0.03)
Denmark	2.2 (0.06)	0.7 (0.03)	2.8 (0.07)	1.1 (0.04)	1.7 (0.06)	0.7 (0.03)
England	2.7 (0.07)	0.9 (0.05)	2.5 (0.06)	0.8 (0.03)	1.5 (0.05)	0.7 (0.03)
France	1.5 (0.04)	0.5 (0.02)	1.5 (0.05)	0.9 (0.03)	1.7 (0.04)	0.8 (0.03)
Germany	1.9 (0.04)	0.8 (0.04)	3.5 (0.07)	0.9 (0.02)	1.7 (0.04)	0.7 (0.02)
Greece	2.1 (0.04)	0.7 (0.03)	1.5 (0.04)	0.9 (0.03)	1.8 (0.04)	1.0 (0.03)
Hong Kong	2.6 (0.05)	0.8 (0.03)	1.2 (0.04)	0.7 (0.02)	0.9 (0.03)	0.9 (0.02)
Hungary	3.0 (0.06)	0.7 (0.03)	2.3 (0.05)	2.0 (0.04)	1.7 (0.04)	1.2 (0.04)
Iceland	2.2 (0.05)	0.7 (0.06)	3.1 (0.06)	0.8 (0.03)	1.8 (0.06)	0.9 (0.06)
Iran, Islamic Rep.	1.8 (0.06)	r 0.2 (0.02)	1.2 (0.04)	1.8 (0.06)	1.2 (0.09)	1.1 (0.04)
Ireland	2.1 (0.03)	0.5 (0.03)	1.5 (0.06)	0.9 (0.03)	1.4 (0.05)	0.6 (0.02)
Israel	3.3 (0.10)	0.9 (0.04)	2.4 (0.08)	1.2 (0.05)	1.9 (0.09)	1.0 (0.04)
Japan	2.6 (0.04)	0.6 (0.02)	1.9 (0.04)	0.6 (0.01)	1.3 (0.03)	0.9 (0.02)
Korea	2.0 (0.04)	0.3 (0.02)	0.9 (0.03)	0.5 (0.02)	0.5 (0.02)	0.8 (0.03)
Kuwait	1.9 (0.07)	0.7 (0.05)	1.5 (0.11)	1.2 (0.08)	1.5 (0.10)	1.0 (0.04)
Latvia (LSS)	2.6 (0.05)	0.7 (0.04)	2.1 (0.06)	1.5 (0.04)	1.2 (0.04)	1.1 (0.03)
Lithuania	2.8 (0.05)	0.9 (0.04)	2.7 (0.06)	1.2 (0.03)	1.2 (0.04)	1.0 (0.03)
Netherlands	2.5 (0.09)	0.7 (0.04)	2.8 (0.08)	0.9 (0.04)	1.8 (0.06)	0.6 (0.03)
New Zealand	2.5 (0.05)	0.7 (0.03)	1.5 (0.04)	0.9 (0.02)	1.5 (0.04)	0.8 (0.02)
Norway	2.5 (0.04)	0.8 (0.03)	3.2 (0.06)	1.1 (0.03)	1.9 (0.05)	0.7 (0.02)
Portugal	2.0 (0.04)	0.7 (0.03)	1.7 (0.05)	1.0 (0.04)	1.7 (0.04)	0.7 (0.02)
Romania	1.9 (0.06)	0.6 (0.05)	1.5 (0.06)	1.9 (0.08)	1.3 (0.05)	1.3 (0.07)
Russian Federation	2.9 (0.05)	1.0 (0.04)	2.9 (0.05)	1.5 (0.03)	1.0 (0.03)	1.3 (0.04)
Scotland	2.7 (0.05)	1.0 (0.04)	2.8 (0.08)	0.7 (0.02)	1.9 (0.05)	0.7 (0.02)
Singapore	2.7 (0.05)	0.6 (0.03)	1.5 (0.04)	1.0 (0.03)	0.7 (0.03)	1.1 (0.02)
Slovak Republic	2.7 (0.05)	0.6 (0.03)	2.9 (0.07)	1.5 (0.05)	1.8 (0.04)	1.0 (0.03)
Slovenia	2.0 (0.04)	0.6 (0.02)	1.7 (0.05)	1.6 (0.05)	1.6 (0.03)	0.9 (0.02)
Spain	1.8 (0.05)	0.3 (0.02)	1.8 (0.06)	1.1 (0.03)	1.7 (0.04)	0.6 (0.02)
Sweden	2.3 (0.04)	0.6 (0.02)	2.3 (0.05)	0.9 (0.02)	1.6 (0.04)	0.7 (0.02)
Switzerland	1.3 (0.03)	0.4 (0.02)	2.4 (0.05)	1.0 (0.03)	1.8 (0.03)	0.8 (0.02)
Thailand	2.1 (0.07)	0.3 (0.02)	1.2 (0.03)	1.6 (0.03)	1.1 (0.02)	1.0 (0.02)
United States	2.6 (0.07)	0.7 (0.03)	2.5 (0.06)	1.2 (0.04)	2.2 (0.05)	0.7 (0.02)

Average hours based on: No Time = 0; Less Than 1 Hour = .5; 1-2 Hours = 1.5; 3-5 Hours = 4; More Than 5 Hours = 7.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

An "r" indicates a 70 - 84% student response rate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Table 4.9

Students' Reports on Total Amount of Daily Out-of-School Study Time[1] Mathematics - Upper Grade (Eighth Grade*)

Country	Less than 1 Hour		1 to < 2 Hours		2 to 3 Hours		More than 3 Hours	
	Percent of Students	**Mean Achievement**	**Percent of Students**	**Mean Achievement**	**Percent of Students**	**Mean Achievement**	**Percent of Students**	**Mean Achievement**
Australia	15 (0.9)	486 (5.7)	46 (1.0)	541 (4.4)	22 (0.6)	543 (5.2)	17 (0.7)	532 (4.8)
Austria	9 (0.8)	524 (6.7)	46 (1.3)	551 (4.1)	21 (0.9)	544 (4.5)	24 (1.2)	528 (5.3)
Belgium (Fl)	2 (0.4)	~ ~	25 (1.3)	552 (8.9)	28 (1.1)	592 (5.9)	45 (1.6)	560 (4.6)
Belgium (Fr)	7 (0.8)	466 (7.1)	32 (1.0)	543 (4.6)	21 (1.3)	544 (5.5)	40 (1.5)	519 (4.5)
Canada	14 (1.2)	514 (5.6)	47 (1.1)	538 (2.8)	18 (0.7)	534 (3.7)	21 (1.1)	511 (3.6)
Colombia	2 (0.4)	~ ~	17 (1.1)	394 (5.2)	20 (1.2)	389 (3.6)	61 (1.9)	390 (3.5)
Cyprus	9 (0.5)	442 (5.8)	19 (0.7)	475 (3.9)	26 (0.8)	491 (4.0)	46 (0.9)	475 (2.9)
Czech Republic	13 (1.1)	551 (7.1)	57 (1.1)	571 (5.1)	17 (0.9)	568 (8.2)	13 (0.8)	542 (7.6)
Denmark	39 (1.6)	517 (4.4)	39 (1.4)	508 (3.8)	13 (0.8)	479 (4.1)	9 (0.7)	468 (6.9)
England	- -	- -	- -	- -	- -	- -	- -	- -
France	8 (0.7)	505 (8.0)	33 (1.2)	545 (3.6)	28 (1.0)	547 (4.5)	31 (1.2)	537 (3.7)
Germany	14 (1.1)	476 (6.7)	51 (1.2)	521 (4.3)	18 (1.0)	524 (7.0)	17 (0.9)	498 (5.0)
Greece	6 (0.6)	450 (7.4)	14 (0.7)	483 (5.2)	21 (0.7)	485 (3.9)	59 (1.2)	491 (3.3)
Hong Kong	13 (1.0)	539 (9.3)	32 (0.9)	586 (6.6)	25 (0.9)	607 (6.1)	30 (1.1)	604 (7.2)
Hungary	4 (0.4)	483 (11.3)	33 (1.1)	536 (5.0)	22 (0.9)	541 (5.2)	41 (1.3)	545 (3.7)
Iceland	5 (1.0)	450 (12.0)	46 (1.7)	501 (5.1)	25 (1.3)	489 (5.4)	23 (1.4)	477 (7.3)
Iran, Islamic Rep.	1 (0.2)	~ ~	5 (0.5)	428 (5.6)	12 (1.0)	436 (4.8)	82 (1.3)	431 (2.4)
Ireland	5 (0.6)	465 (8.8)	29 (1.0)	517 (5.3)	40 (1.1)	547 (5.5)	26 (1.2)	533 (5.7)
Israel	5 (0.6)	539 (10.9)	36 (2.2)	546 (6.3)	26 (1.5)	521 (6.8)	33 (2.1)	502 (6.3)
Japan	13 (0.8)	578 (5.3)	39 (0.8)	607 (2.6)	20 (0.6)	609 (4.0)	28 (1.0)	612 (2.7)
Korea	15 (0.9)	582 (4.9)	32 (1.1)	604 (3.5)	25 (0.8)	607 (4.0)	29 (1.2)	628 (4.3)
Kuwait	3 (0.6)	358 (10.3)	13 (1.5)	401 (5.5)	19 (1.3)	397 (5.1)	65 (1.8)	392 (2.0)
Latvia (LSS)	4 (0.5)	467 (9.4)	35 (1.1)	507 (4.4)	32 (1.2)	497 (4.9)	29 (1.2)	487 (3.4)
Lithuania	5 (0.6)	453 (9.4)	39 (1.4)	487 (3.9)	28 (1.0)	481 (4.6)	28 (1.4)	474 (5.4)
Netherlands	3 (0.9)	492 (16.2)	54 (1.7)	539 (9.0)	27 (1.7)	562 (7.0)	16 (0.8)	524 (6.0)
New Zealand	12 (0.9)	472 (5.6)	51 (1.2)	519 (4.7)	21 (1.0)	518 (6.1)	17 (0.9)	495 (5.6)
Norway	6 (0.5)	481 (6.8)	50 (1.2)	514 (2.9)	24 (0.9)	510 (3.6)	21 (0.9)	483 (3.6)
Portugal	3 (0.3)	458 (8.1)	41 (1.1)	463 (3.1)	18 (0.7)	455 (3.3)	38 (1.2)	448 (3.0)
Romania	9 (0.7)	459 (10.4)	16 (1.0)	464 (7.0)	15 (0.7)	481 (5.4)	60 (1.6)	494 (4.2)
Russian Federation	4 (0.5)	493 (10.3)	33 (1.1)	538 (5.3)	25 (1.0)	538 (5.2)	38 (1.4)	544 (6.9)
Scotland	17 (1.4)	461 (4.8)	54 (1.2)	506 (5.7)	17 (1.0)	517 (8.6)	12 (0.8)	503 (7.4)
Singapore	2 (0.3)	~ ~	7 (0.4)	642 (8.0)	13 (0.6)	652 (6.6)	78 (0.9)	643 (4.9)
Slovak Republic	6 (0.5)	549 (8.3)	46 (0.9)	556 (3.9)	25 (0.7)	548 (4.4)	23 (1.0)	532 (4.1)
Slovenia	5 (0.5)	551 (9.8)	36 (1.0)	561 (4.1)	21 (0.8)	537 (4.8)	37 (1.1)	523 (3.4)
Spain	3 (0.4)	443 (5.5)	26 (1.0)	490 (3.1)	18 (0.9)	495 (3.3)	53 (1.3)	487 (2.4)
Sweden	7 (0.6)	496 (6.9)	55 (1.2)	528 (3.1)	17 (0.8)	525 (4.3)	21 (0.9)	503 (4.2)
Switzerland	4 (0.3)	523 (7.9)	44 (1.2)	556 (3.4)	19 (0.8)	548 (5.1)	33 (1.1)	536 (4.0)
Thailand	3 (0.3)	495 (11.9)	26 (1.0)	514 (5.4)	18 (0.7)	515 (5.7)	54 (1.5)	531 (6.6)
United States	17 (1.1)	471 (7.2)	42 (0.9)	514 (4.2)	17 (0.7)	507 (5.5)	24 (0.8)	498 (5.9)

[1] Sum of time reported spent studying or doing homework in mathematics, science, and other subjects.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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homework, perhaps because they need to spend the extra time to keep up academically. In some countries, students doing one hour a day of homework or more had higher average mathematics achievement than students doing less than one hour a day (e.g., Greece, Japan, the Russian Federation, and Spain), although in these countries there was little difference in achievement as the time spent increased from at least one hour to more than three hours. A direct positive relationship between time spent doing homework and mathematics achievement was found in other countries, such as Korea and Romania. The only inverse relationship was noted for Denmark. Clearly, different countries have different policies and practices about assigning homework.

The relationship between mathematics achievement and amount of time spent watching television each day was more consistent across countries than that with doing homework (see Table 4.10). In about half the TIMSS countries, the highest mathematics achievement was associated with watching from one to two hours of television per day. This was the most common response, reflecting from 33% to 54% of the students for all countries. That watching less than one hour of television per day generally was associated with lower average mathematics achievement than watching one to two hours in many countries most likely has little to do with the influence of television viewing on mathematics achievement. For these students, low television viewing may be a surrogate socio-economic indicator, suggesting something about children's access to television sets across countries. Because students with fewer socio-economic advantages generally perform less well than their counterparts academically, it may be that students who reported less than one hour watching television each day simply do not have television sets in their homes, or come from homes with only one television set where they have less opportunity to spend a lot of time watching their choice of programming.

In general, beyond one to two hours of television viewing per day, the more television eighth-graders reported watching, the lower their mathematics achievement, although there were several countries where students watching three to five hours of television did not have lower achievement than those watching one to two hours. In all countries, however, students watching more than five hours of television per day had the lowest average mathematics achievement. Countries where 10% or more of the students reported watching more than five hours of television each day included Colombia, England, Hong Kong, Hungary, Israel, Latvia (LSS), Lithuania, New Zealand, the Russian Federation, Scotland, the Slovak Republic, and the United States.

Table 4.10

Students' Reports on the Hours Spent Each Day Watching Television and Videos Mathematics - Upper Grade (Eighth Grade*)

Country	Less than 1 Hour		1 to 2 Hours		3 to 5 Hours		More than 5 Hours	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	24 (0.9)	539 (6.0)	41 (0.8)	539 (4.1)	27 (0.8)	528 (3.8)	9 (0.6)	487 (5.5)
Austria	25 (1.4)	540 (5.4)	53 (1.1)	546 (4.2)	17 (1.0)	539 (5.2)	5 (0.6)	497 (8.6)
Belgium (Fl)	24 (1.2)	580 (6.7)	52 (1.2)	575 (6.2)	19 (1.0)	535 (7.1)	5 (0.5)	514 (12.1)
Belgium (Fr)	33 (1.3)	536 (4.2)	44 (1.8)	536 (4.9)	17 (1.3)	522 (4.0)	6 (1.0)	445 (9.0)
Canada	22 (0.7)	522 (2.9)	46 (0.8)	534 (3.5)	25 (0.7)	532 (3.0)	7 (0.6)	504 (5.2)
Colombia	31 (1.5)	384 (4.9)	39 (1.2)	397 (3.3)	20 (1.2)	391 (5.2)	11 (1.0)	374 (5.3)
Cyprus	25 (1.1)	466 (4.4)	45 (1.1)	486 (2.7)	21 (0.8)	479 (3.7)	9 (0.7)	441 (5.7)
Czech Republic	15 (0.8)	556 (7.5)	45 (1.2)	575 (6.2)	31 (1.2)	562 (4.3)	9 (0.8)	531 (8.9)
Denmark	28 (1.1)	499 (3.9)	42 (1.2)	507 (4.0)	22 (1.0)	510 (4.5)	8 (0.7)	488 (6.0)
England	20 (1.3)	500 (8.1)	37 (1.2)	515 (3.9)	31 (1.2)	516 (3.7)	11 (0.9)	481 (6.1)
France	42 (1.3)	546 (3.9)	45 (1.1)	539 (2.9)	9 (0.7)	532 (5.5)	4 (0.5)	494 (10.8)
Germany	31 (1.0)	510 (6.2)	47 (1.1)	517 (4.5)	16 (0.8)	511 (5.9)	6 (0.6)	467 (7.4)
Greece	32 (0.9)	486 (3.5)	42 (0.7)	489 (3.7)	17 (0.7)	486 (4.9)	9 (0.5)	470 (5.7)
Hong Kong	22 (0.9)	582 (7.7)	39 (0.9)	599 (6.8)	28 (1.0)	599 (6.5)	11 (0.8)	556 (9.1)
Hungary	11 (0.7)	550 (6.2)	41 (1.1)	552 (4.0)	33 (0.9)	537 (3.9)	15 (1.0)	496 (5.2)
Iceland	24 (1.3)	475 (7.4)	47 (1.3)	494 (4.5)	22 (1.2)	498 (5.7)	7 (0.8)	473 (11.8)
Iran, Islamic Rep.	32 (1.3)	421 (3.1)	46 (0.9)	434 (2.9)	17 (0.9)	438 (4.1)	5 (0.6)	425 (7.9)
Ireland	20 (0.8)	517 (6.4)	51 (1.1)	539 (5.2)	23 (0.8)	531 (5.3)	5 (0.5)	486 (8.5)
Israel	9 (1.4)	506 (17.0)	33 (2.1)	536 (7.0)	44 (1.7)	525 (5.4)	14 (1.2)	505 (7.8)
Japan	9 (0.5)	606 (5.7)	53 (0.9)	615 (2.1)	30 (0.8)	596 (3.4)	9 (0.5)	569 (5.1)
Korea	32 (1.0)	612 (4.6)	40 (1.0)	618 (3.4)	20 (0.8)	595 (5.3)	7 (0.6)	570 (6.9)
Kuwait	39 (1.7)	386 (2.9)	38 (1.3)	398 (3.3)	14 (1.2)	400 (3.8)	9 (0.8)	384 (4.1)
Latvia (LSS)	16 (1.0)	474 (4.4)	44 (1.1)	500 (3.7)	29 (1.2)	509 (4.2)	10 (0.7)	475 (5.1)
Lithuania	12 (0.7)	469 (6.2)	44 (1.3)	480 (4.6)	32 (1.2)	483 (4.0)	12 (0.9)	472 (5.8)
Netherlands	17 (1.8)	544 (14.0)	47 (1.7)	556 (7.0)	27 (1.5)	529 (6.3)	9 (0.9)	496 (7.3)
New Zealand	24 (1.0)	506 (6.4)	38 (0.9)	521 (4.8)	26 (0.9)	510 (4.7)	12 (0.8)	474 (5.7)
Norway	15 (0.7)	508 (4.2)	48 (1.0)	509 (2.5)	30 (1.0)	503 (3.7)	7 (0.4)	470 (6.0)
Portugal	27 (1.0)	450 (3.3)	48 (0.9)	458 (2.9)	20 (0.8)	460 (3.3)	5 (0.5)	440 (5.3)
Romania	38 (1.4)	475 (5.6)	39 (1.2)	489 (5.5)	16 (0.9)	495 (5.6)	8 (0.7)	470 (7.7)
Russian Federation	12 (1.0)	515 (6.9)	42 (1.4)	538 (5.9)	32 (1.0)	547 (4.8)	14 (0.9)	535 (7.5)
Scotland	15 (0.7)	488 (7.2)	43 (1.0)	504 (6.9)	31 (1.0)	508 (5.9)	11 (0.7)	472 (4.8)
Singapore	7 (0.6)	657 (7.2)	50 (1.1)	650 (5.2)	37 (1.2)	636 (5.2)	6 (0.5)	619 (8.6)
Slovak Republic	14 (0.7)	561 (7.4)	47 (1.0)	550 (3.5)	28 (0.9)	547 (4.1)	11 (0.8)	523 (5.6)
Slovenia	23 (1.1)	546 (4.1)	54 (1.1)	541 (3.4)	19 (0.9)	540 (4.7)	4 (0.4)	518 (9.9)
Spain	33 (1.2)	481 (3.0)	46 (1.0)	494 (2.4)	17 (0.8)	489 (3.9)	4 (0.5)	464 (5.1)
Sweden	16 (0.7)	518 (4.9)	51 (0.9)	528 (3.3)	27 (0.8)	514 (3.7)	6 (0.5)	478 (5.5)
Switzerland	45 (1.5)	556 (4.1)	44 (1.3)	543 (3.2)	9 (0.7)	528 (6.6)	2 (0.2)	~ ~
Thailand	28 (1.4)	510 (4.7)	46 (1.0)	524 (6.4)	19 (1.1)	540 (7.3)	8 (0.7)	521 (6.9)
United States	22 (0.8)	504 (5.7)	40 (0.9)	513 (5.1)	25 (0.6)	501 (4.2)	13 (1.0)	461 (4.6)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

HOW DO STUDENTS PERCEIVE SUCCESS IN MATHEMATICS?

Table 4.11 presents eighth-grade students' perceptions about doing well in mathematics. In all except four countries, the majority of students agreed or strongly agreed that they did well in mathematics. The four exceptions, where more than 50% of the students disagreed or strongly disagreed about doing well, were Hong Kong (62%), Japan (55%), Korea (62%), and Lithuania (51%). Notably, three of those countries were among the very highest performing countries. Countries where 80% or more of the eighth-graders felt they were usually good at mathematics represented a range in mathematics performance – Australia, Canada, Colombia, Denmark, England, Greece, Iceland, Iran, Israel, Kuwait, New Zealand, Scotland, Sweden, and the United States.

Figure 4.2 indicates that, internationally, eighth-grade girls had lower self-perceptions than boys about how well they usually do in mathematics. This figure and the distributions shown in Table 4.11 also show that, on average, both boys and girls in the participating countries tended to agree (or sometimes disagree) about usually doing well in mathematics rather than report the extremes of strongly agreeing or disagreeing. For most countries both boys and girls tended to indicate that they did well in mathematics – a perception that did not always coincide with their achievement on the TIMSS mathematics test.

Table 4.11

Students' Self-Perceptions About Usually Doing Well in Mathematics
Upper Grade (Eighth Grade*)

Country	Strongly Disagree		Disagree		Agree		Strongly Agree	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	3 (0.3)	457 (7.9)	17 (0.7)	487 (5.6)	60 (0.8)	530 (3.9)	20 (0.9)	586 (4.7)
Austria	3 (0.4)	512 (10.1)	21 (1.1)	508 (5.4)	45 (1.2)	535 (4.0)	31 (1.4)	572 (4.3)
Belgium (Fl)	5 (0.4)	512 (6.7)	29 (1.0)	548 (5.9)	48 (1.1)	567 (6.4)	17 (0.9)	609 (7.2)
Belgium (Fr)	3 (0.4)	467 (7.8)	19 (1.3)	505 (5.4)	48 (1.3)	528 (3.8)	29 (1.5)	550 (5.0)
Canada	3 (0.3)	480 (9.0)	13 (0.6)	480 (4.9)	49 (1.1)	514 (2.3)	35 (1.1)	570 (3.4)
Colombia	2 (0.4)	~ ~	17 (1.3)	373 (3.7)	51 (1.9)	385 (4.6)	30 (1.4)	398 (5.3)
Cyprus	5 (0.4)	411 (7.6)	18 (0.8)	432 (3.7)	46 (1.0)	469 (2.6)	31 (1.0)	521 (4.4)
Czech Republic	2 (0.3)	~ ~	37 (1.4)	516 (4.2)	48 (1.4)	584 (5.2)	13 (1.0)	640 (8.0)
Denmark	1 (0.2)	~ ~	8 (0.6)	431 (7.0)	53 (1.4)	492 (3.0)	38 (1.3)	537 (4.0)
England	1 (0.2)	~ ~	6 (0.6)	475 (8.3)	69 (1.0)	500 (3.0)	24 (1.0)	538 (5.8)
France	6 (0.7)	495 (6.1)	26 (1.1)	513 (4.0)	46 (1.0)	548 (3.4)	22 (0.8)	564 (5.1)
Germany	7 (0.5)	474 (7.1)	24 (1.0)	491 (5.2)	33 (1.1)	511 (5.1)	36 (1.1)	529 (5.3)
Greece	2 (0.3)	~ ~	16 (0.7)	454 (3.6)	55 (0.8)	481 (3.2)	27 (0.8)	515 (4.2)
Hong Kong	11 (0.9)	536 (9.5)	51 (1.2)	577 (6.7)	33 (1.2)	620 (6.7)	5 (0.5)	643 (8.2)
Hungary	3 (0.3)	469 (11.7)	25 (0.9)	490 (4.2)	57 (1.0)	545 (3.4)	15 (0.8)	608 (4.8)
Iceland	3 (0.6)	421 (10.1)	14 (1.4)	447 (4.9)	55 (1.6)	486 (4.5)	28 (1.8)	519 (9.5)
Iran, Islamic Rep.	1 (0.4)	~ ~	8 (0.7)	403 (4.3)	62 (1.4)	423 (2.6)	29 (1.4)	450 (3.7)
Ireland	3 (0.3)	475 (7.7)	18 (1.0)	492 (5.5)	61 (0.9)	530 (5.2)	18 (1.0)	572 (7.6)
Israel	2 (0.4)	~ ~	12 (1.3)	494 (10.1)	45 (1.9)	513 (6.2)	41 (1.9)	549 (8.3)
Japan	10 (0.5)	523 (3.7)	45 (0.7)	577 (2.3)	40 (0.7)	650 (2.5)	4 (0.3)	669 (7.8)
Korea	9 (0.5)	535 (5.7)	53 (1.0)	572 (3.0)	32 (0.9)	669 (3.0)	6 (0.6)	702 (5.7)
Kuwait	3 (0.7)	364 (11.3)	9 (0.9)	382 (3.6)	49 (1.7)	386 (2.4)	39 (2.1)	405 (3.9)
Latvia (LSS)	2 (0.3)	~ ~	43 (1.2)	471 (3.5)	43 (1.2)	505 (3.7)	12 (0.8)	542 (5.5)
Lithuania	5 (0.5)	446 (7.5)	46 (1.2)	454 (3.4)	38 (1.2)	492 (4.3)	11 (0.8)	544 (6.0)
Netherlands	4 (0.5)	487 (12.4)	21 (1.4)	504 (7.1)	43 (1.3)	537 (8.4)	32 (1.6)	580 (7.3)
New Zealand	2 (0.3)	~ ~	13 (0.8)	466 (6.1)	62 (0.9)	501 (4.5)	22 (0.8)	559 (5.5)
Norway	3 (0.3)	434 (7.4)	18 (0.9)	455 (3.2)	58 (1.0)	504 (2.2)	21 (0.8)	555 (4.4)
Portugal	7 (0.5)	419 (3.6)	37 (1.1)	435 (2.3)	42 (1.1)	463 (2.5)	14 (0.8)	502 (5.2)
Romania	6 (0.6)	455 (12.0)	25 (1.0)	459 (4.6)	49 (0.9)	488 (4.3)	20 (1.0)	505 (6.3)
Russian Federation	2 (0.3)	~ ~	37 (1.4)	501 (7.1)	43 (1.1)	547 (5.1)	18 (0.8)	590 (4.9)
Scotland	2 (0.3)	~ ~	10 (0.8)	455 (5.5)	66 (1.3)	491 (4.8)	22 (1.3)	553 (9.3)
Singapore	6 (0.4)	587 (9.0)	38 (1.2)	624 (5.2)	46 (1.1)	659 (4.9)	11 (0.6)	677 (6.2)
Slovak Republic	1 (0.2)	~ ~	28 (1.1)	496 (3.8)	55 (1.1)	555 (3.8)	15 (0.7)	619 (5.2)
Slovenia	2 (0.3)	~ ~	24 (1.1)	497 (4.0)	53 (1.0)	538 (3.6)	21 (0.9)	602 (4.2)
Spain	5 (0.5)	441 (4.6)	23 (1.0)	456 (2.6)	45 (1.1)	488 (2.6)	27 (1.0)	522 (3.4)
Sweden	2 (0.3)	~ ~	16 (0.7)	475 (3.4)	61 (0.9)	517 (3.0)	21 (0.8)	565 (3.8)
Switzerland	3 (0.4)	497 (10.1)	21 (0.9)	528 (4.0)	47 (0.9)	541 (3.0)	28 (1.1)	575 (3.3)
Thailand	2 (0.3)	~ ~	38 (1.5)	510 (5.1)	45 (1.1)	529 (6.6)	15 (0.9)	537 (7.4)
United States	3 (0.3)	430 (5.1)	11 (0.6)	462 (4.8)	52 (0.9)	491 (4.3)	34 (1.0)	534 (5.9)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

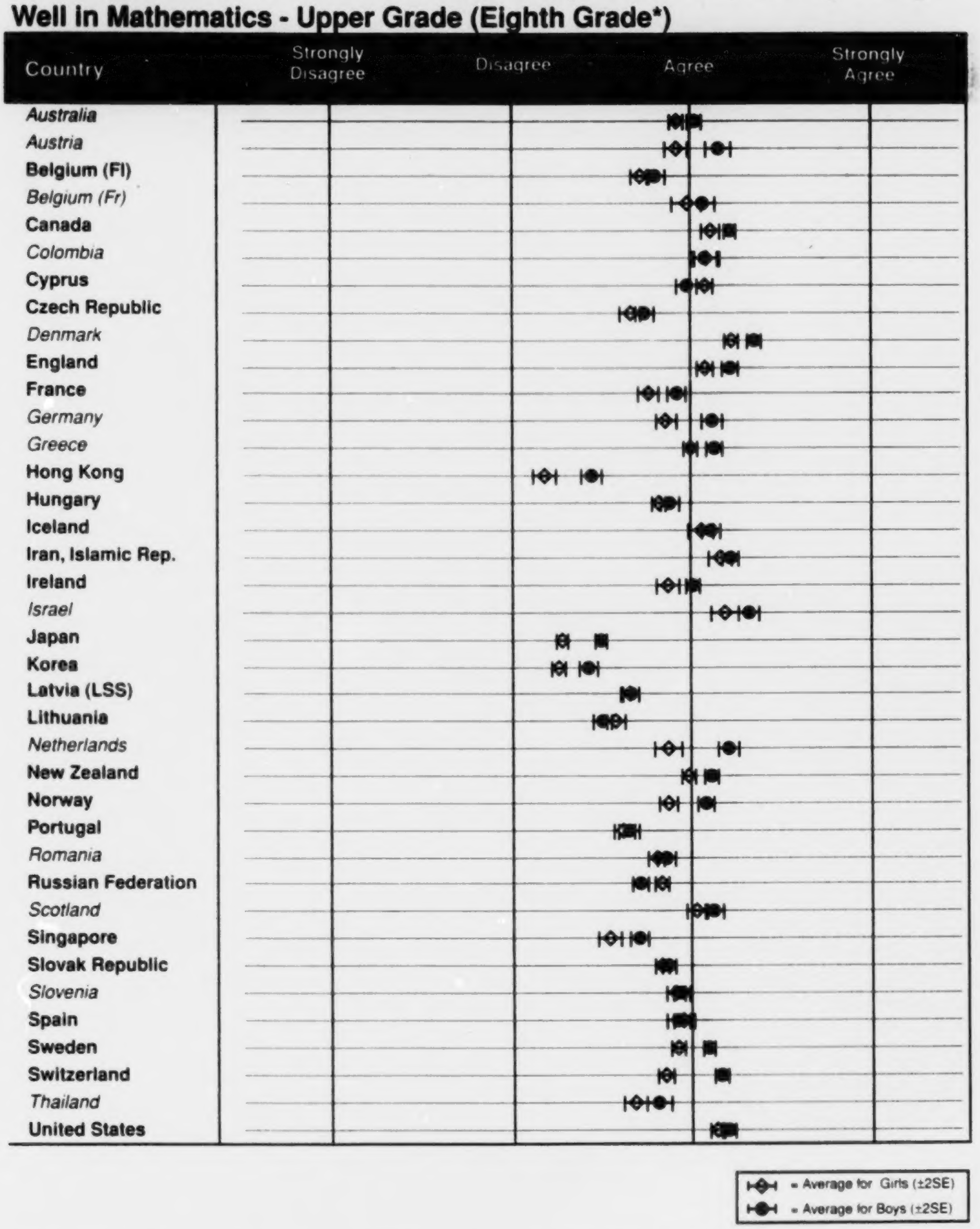
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 4.2

Gender Differences in Students' Self-Perceptions About Usually Doing Well in Mathematics - Upper Grade (Eighth Grade*)



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*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background Data for Bulgaria and South Africa are unavailable.
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Students were asked about the necessity of various attributes or activities to do well in mathematics (see Table 4.12). There was enormous variation from country to country in the percentage of eighth-grade students agreeing that natural talent or ability were important to do well in mathematics. Fewer than 50% of the students agreed in England, France, Iceland, the Netherlands, and Sweden compared to 90% or more in Colombia, Denmark, Hungary, and Iran. Internationally, relatively few students agreed that good luck was important to do well. The countries where more than 50% of the eighth-graders agreed that good luck was needed to do well in mathematics included Colombia, the Czech Republic, Hungary, Iran, Japan, Korea, Kuwait, Latvia (LSS), Lithuania, Romania, the Russian Federation, and the Slovak Republic.

Internationally, there was a high degree of agreement among students that lots of hard work studying at home was necessary in order to do well in mathematics. Percentages of agreement were in the 80s and 90s for most countries, and in the 70s for Austria, Germany, Hungary, Switzerland, and Thailand. The variation was substantial from country to country regarding students' agreement with the necessity of memorizing the textbook or notes. In Belgium (French), France, Iceland, Japan, Kuwait, and Thailand, 90% or more of the eighth-grade students agreed or strongly agreed that memorization was important to doing well in mathematics. In contrast, fewer than 40% so agreed in Austria, Latvia (LSS), Lithuania, Singapore, the Slovak Republic, Slovenia, Sweden, and Switzerland.

Table 4.12

Students' Reports on Things Necessary to Do Well in Mathematics Upper Grade (Eighth Grade*)

Country	Percent of Students Responding Agree or Strongly Agree			
	Natural Talent/Ability	Good Luck	Lots of Hard Work Studying at Home	Memorize the Textbook or Notes
Australia	66 (0.8)	30 (0.8)	92 (0.5)	67 (0.8)
Austria	70 (1.4)	27 (1.2)	78 (1.2)	39 (1.2)
Belgium (Fl)	58 (1.7)	22 (2.0)	85 (1.1)	51 (1.8)
Belgium (Fr)	69 (1.3)	23 (1.3)	93 (0.8)	93 (0.5)
Canada	61 (1.0)	26 (0.9)	87 (0.7)	42 (0.9)
Colombia	91 (1.0)	62 (1.4)	97 (0.3)	74 (1.4)
Cyprus	51 (1.0)	34 (1.1)	92 (0.6)	71 (1.2)
Czech Republic	61 (1.0)	57 (1.2)	81 (1.0)	41 (1.8)
Denmark	90 (0.7)	28 (1.3)	87 (1.0)	61 (1.5)
England	45 (1.3)	23 (1.0)	93 (0.7)	49 (1.2)
France	40 (1.4)	21 (1.1)	90 (0.7)	95 (0.7)
Germany	59 (1.5)	25 (1.1)	76 (1.1)	47 (1.5)
Greece	54 (0.9)	26 (0.9)	95 (0.5)	84 (0.7)
Hong Kong	77 (1.0)	38 (1.0)	95 (0.6)	69 (1.5)
Hungary	95 (0.5)	56 (1.0)	79 (1.1)	47 (1.5)
Iceland	37 (1.8)	24 (1.5)	92 (0.8)	94 (1.0)
Iran, Islamic Rep.	95 (0.5)	51 (2.5)	96 (0.4)	89 (0.9)
Ireland	72 (1.0)	31 (1.2)	95 (0.5)	69 (1.1)
Israel	55 (2.1)	17 (1.6)	96 (0.6)	40 (2.1)
Japan	82 (0.6)	59 (1.0)	96 (0.3)	92 (0.6)
Korea	86 (0.7)	63 (1.0)	98 (0.2)	73 (0.7)
Kuwait	87 (1.3)	76 (1.7)	83 (1.4)	91 (0.8)
Latvia (LSS)	61 (1.1)	63 (1.4)	91 (0.7)	38 (1.3)
Lithuania	85 (1.0)	69 (1.1)	83 (0.9)	28 (1.5)
Netherlands	44 (1.5)	23 (1.5)	89 (0.9)	53 (1.7)
New Zealand	62 (1.1)	27 (1.2)	92 (0.5)	72 (1.2)
Norway	86 (0.6)	19 (0.8)	92 (0.6)	74 (1.1)
Portugal	72 (1.0)	39 (1.3)	97 (0.3)	56 (1.5)
Romania	66 (1.1)	59 (1.3)	88 (0.7)	73 (1.3)
Russian Federation	79 (1.0)	51 (1.4)	89 (0.8)	61 (1.9)
Scotland	- -	- -	- -	- -
Singapore	84 (0.7)	41 (1.0)	92 (0.7)	32 (1.6)
Slovak Republic	69 (1.1)	52 (1.1)	90 (0.6)	35 (1.1)
Slovenia	81 (1.0)	38 (1.3)	82 (1.0)	16 (1.0)
Spain	66 (1.2)	35 (1.0)	89 (0.8)	60 (1.4)
Sweden	48 (1.0)	24 (1.0)	83 (0.7)	33 (0.9)
Switzerland	60 (1.2)	22 (0.9)	71 (1.0)	36 (1.4)
Thailand	69 (1.2)	34 (1.1)	77 (0.9)	96 (0.4)
United States	50 (1.0)	32 (1.2)	90 (0.6)	59 (1.1)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

A dash (-) indicates data are not available.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Students also were asked about why they need to do well in mathematics. Students could agree with any or all of the three areas of possible motivation presented in Table 4.13, including getting their desired job, to please their parents, and to get into their desired secondary school or university. There were substantial differences from country to country in students' responses. In Colombia, Cyprus, Iran, Kuwait, and Scotland, 50% or more of the eighth-graders strongly agreed that they needed to do well in mathematics to get their desired job. The majority of students in nearly all countries either agreed or strongly agreed that getting their desired job was a motivating factor, except Korea, where 53% of the students disagreed or strongly disagreed.

In Iran, Kuwait, and Thailand, 50% or more of the students strongly agreed that they needed to do well in mathematics to please their parents. Even though in most countries the majority of the eighth-grade students agreed at some level that pleasing their parents was important, 50% or more disagreed or strongly disagreed in Denmark, Iceland, Japan, the Netherlands, Slovenia, and Sweden. Internationally, the reason most frequently cited by students for needing to do well in mathematics was to get into students' desired secondary school or university. With the exception of Austria, Belgium (Flemish), Germany, the Netherlands, and Switzerland, three-fourths or more of the students strongly agreed or agreed that this was a motivating factor for doing well in mathematics.

Table 4.13

Students' Reports on Why They Need to Do Well in Mathematics Upper Grade (Eighth Grade*)

Country	Percent of Students								
	Get Desired Job			Please Parents			Get into Desired Secondary School or University		
	Strongly Agree	Agree	Disagree/ Strongly Disagree	Strongly Agree	Agree	Disagree/ Strongly Disagree	Strongly Agree	Agree	Disagree/ Strongly Disagree
Australia	36 (0.9)	43 (0.8)	21 (0.7)	22 (0.7)	50 (0.7)	28 (0.6)	36 (0.9)	42 (0.8)	22 (1.0)
Austria	33 (1.3)	31 (0.8)	36 (1.5)	17 (1.0)	37 (1.2)	46 (1.3)	36 (1.4)	27 (1.3)	37 (1.6)
Belgium (Fl)	17 (0.9)	40 (1.1)	43 (1.5)	16 (0.8)	53 (1.2)	32 (1.2)	27 (1.1)	47 (0.9)	26 (1.0)
Belgium (Fr)	35 (1.3)	36 (1.4)	29 (1.2)	28 (1.6)	49 (1.2)	23 (1.2)	36 (1.2)	41 (1.3)	23 (1.1)
Canada	44 (0.9)	41 (1.0)	15 (0.6)	23 (0.7)	44 (0.9)	32 (1.1)	55 (1.4)	37 (1.2)	8 (0.5)
Colombia	50 (1.7)	35 (1.3)	15 (0.9)	41 (2.2)	36 (1.2)	23 (1.5)	63 (1.2)	31 (1.1)	6 (0.5)
Cyprus	53 (1.1)	34 (1.0)	13 (0.8)	34 (0.9)	37 (1.1)	30 (1.0)	50 (1.0)	32 (0.9)	18 (0.9)
Czech Republic	32 (1.3)	50 (1.1)	17 (1.2)	23 (1.1)	61 (1.0)	16 (0.8)	45 (1.0)	40 (1.2)	15 (0.9)
Denmark	32 (1.2)	39 (1.3)	29 (1.1)	13 (1.3)	28 (1.2)	59 (1.7)	40 (1.5)	45 (1.4)	14 (1.0)
England	37 (1.1)	43 (1.1)	20 (0.9)	20 (1.1)	43 (1.3)	36 (1.5)	41 (1.2)	45 (1.1)	14 (1.0)
France	35 (1.1)	36 (1.0)	29 (1.2)	17 (1.0)	42 (1.4)	41 (1.4)	42 (1.1)	42 (1.0)	17 (0.9)
Germany	39 (1.3)	31 (1.1)	30 (1.0)	25 (1.2)	32 (0.9)	43 (1.2)	32 (1.1)	33 (1.1)	35 (1.2)
Greece	45 (0.9)	37 (1.0)	17 (0.6)	37 (1.2)	39 (0.9)	25 (0.8)	51 (0.9)	34 (0.9)	15 (0.6)
Hong Kong	24 (1.0)	52 (0.9)	24 (0.8)	16 (0.7)	43 (0.9)	41 (1.1)	32 (0.9)	51 (0.9)	17 (0.8)
Hungary	22 (1.0)	55 (1.0)	23 (1.1)	10 (0.7)	53 (1.0)	36 (1.2)	32 (1.0)	43 (1.0)	25 (1.2)
Iceland	32 (1.8)	47 (2.0)	21 (1.2)	13 (1.4)	30 (1.3)	57 (2.1)	49 (1.5)	44 (1.9)	7 (0.8)
Iran, Islamic Rep.	62 (1.2)	28 (1.0)	10 (0.9)	69 (1.3)	25 (1.3)	5 (0.6)	73 (1.3)	22 (1.0)	5 (0.7)
Ireland	40 (1.1)	40 (1.1)	20 (0.9)	19 (0.9)	43 (0.8)	38 (1.0)	42 (1.1)	40 (1.1)	18 (1.2)
Israel	45 (1.8)	34 (1.5)	21 (1.1)	21 (1.4)	36 (2.0)	44 (2.0)	68 (1.8)	28 (1.6)	4 (0.6)
Japan	12 (0.5)	43 (0.7)	45 (0.8)	6 (0.4)	28 (0.7)	66 (0.9)	35 (0.7)	56 (0.8)	9 (0.9)
Korea	13 (0.8)	34 (0.8)	53 (1.1)	11 (0.7)	44 (1.2)	44 (1.3)	35 (1.2)	51 (1.0)	14 (0.8)
Kuwait	50 (2.4)	34 (1.7)	15 (1.2)	64 (2.2)	29 (1.7)	8 (0.8)	63 (1.5)	25 (1.1)	12 (1.1)
Latvia (LSS)	39 (1.2)	46 (1.0)	15 (1.0)	29 (1.4)	50 (1.3)	20 (1.0)	45 (1.3)	44 (1.1)	11 (0.7)
Lithuania	43 (1.4)	44 (1.3)	13 (0.9)	16 (0.9)	37 (1.3)	47 (1.3)	41 (1.2)	42 (1.3)	17 (1.0)
Netherlands	16 (1.1)	37 (1.4)	47 (1.3)	8 (1.0)	35 (1.4)	57 (1.7)	19 (1.1)	47 (1.2)	33 (1.3)
New Zealand	41 (1.0)	42 (0.9)	17 (0.7)	22 (0.8)	44 (1.0)	34 (1.0)	37 (1.0)	44 (0.9)	20 (0.7)
Norway	24 (0.9)	49 (0.9)	28 (0.9)	14 (0.8)	38 (0.9)	48 (1.0)	37 (1.0)	52 (1.0)	11 (0.7)
Portugal	37 (0.8)	39 (0.9)	23 (0.8)	22 (1.0)	44 (1.0)	34 (1.1)	43 (1.1)	40 (1.0)	17 (0.8)
Romania	40 (1.2)	38 (1.0)	22 (1.1)	33 (1.0)	43 (1.1)	24 (1.0)	46 (1.2)	36 (1.0)	18 (1.0)
Russian Federation	42 (0.9)	40 (0.9)	18 (0.9)	26 (1.0)	45 (1.2)	29 (1.2)	44 (1.1)	39 (1.1)	17 (0.7)
Scotland	51 (1.2)	36 (1.1)	12 (0.6)	22 (0.9)	43 (1.0)	34 (1.0)	51 (1.2)	33 (1.1)	16 (1.0)
Singapore	37 (0.8)	48 (0.6)	15 (0.7)	20 (0.6)	46 (0.8)	34 (1.0)	51 (1.0)	44 (1.0)	5 (0.3)
Slovak Republic	31 (0.9)	48 (1.0)	20 (0.9)	15 (0.7)	56 (1.0)	29 (1.1)	42 (0.9)	51 (0.9)	7 (0.5)
Slovenia	27 (1.1)	51 (1.1)	22 (1.0)	8 (0.6)	35 (1.3)	56 (1.5)	39 (1.1)	49 (1.1)	12 (0.7)
Spain	31 (1.0)	39 (0.9)	29 (0.8)	36 (1.0)	45 (0.9)	18 (0.9)	47 (1.0)	41 (0.9)	12 (0.5)
Sweden	24 (0.9)	47 (0.9)	29 (0.8)	11 (0.7)	35 (0.9)	54 (1.1)	29 (0.9)	53 (0.9)	18 (0.6)
Switzerland	30 (1.0)	36 (0.9)	34 (1.0)	18 (1.0)	39 (0.9)	43 (0.9)	32 (0.9)	39 (1.1)	28 (0.9)
Thailand	47 (1.1)	48 (1.0)	4 (0.4)	54 (1.1)	44 (1.1)	2 (0.3)	61 (1.1)	37 (1.0)	2 (0.3)
United States	47 (1.2)	39 (0.8)	15 (0.7)	35 (0.9)	45 (0.7)	20 (0.8)	64 (1.2)	32 (1.0)	4 (0.3)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

WHAT ARE STUDENTS' ATTITUDES TOWARDS MATHEMATICS?

To collect information on eighth-grade students' perceptions of mathematics, TIMSS asked them a series of questions about its utility, importance, and enjoyability. Students' perceptions about the value of learning mathematics may be considered as both an input and outcome variable, because their attitudes towards the subject can be related to educational achievement in ways that reinforce higher or lower performance. That is, students who do well in mathematics generally have more positive attitudes towards the subject, and those who have more positive attitudes tend to perform better.

Table 4.14 provides students' responses to the question about how much they like or dislike mathematics in relation to their average mathematics achievement. As anticipated, within nearly every country, a clear positive relationship can be observed between a stronger liking of mathematics and higher achievement. Even though the majority of eighth-graders in nearly every country indicated they liked mathematics to some degree, clearly not all students feel positive about this subject area. In Austria, the Czech Republic, Germany, Hungary, Japan, Korea, Lithuania, and the Netherlands, more than 40% of the eighth-grade students reported disliking mathematics.

The data in Figure 4.3 reveal that, on average, eighth-graders of both genders were relatively neutral about liking mathematics. In no country did girls report a significantly stronger liking of the subject area than did boys. However, boys reported liking mathematics better than girls did in several countries, including Austria, France, Germany, Hong Kong, Japan, Norway, and Switzerland.

To gain some understanding about eighth-graders' view about the utility of mathematics and their enjoyment of it as a school subject, TIMSS asked students to state their level of agreement with the following four statements: 1) I would like a job that involved using mathematics, 2) Mathematics is important to everyone's life, 3) Mathematics is boring, and 4) I enjoy learning mathematics. The results for these four questions were averaged with students' responses to the question about liking mathematics to form an index of their overall attitudes towards mathematics based on all five questions.

The data for the index in Table 4.15 reveal that eighth-grade students generally had positive attitudes towards mathematics, and that those students with more positive attitudes had higher average mathematics achievement. On average, across the five questions comprising the mathematics attitude index, the majority of students in each TIMSS country expressed positive or strongly positive attitudes about mathematics. Very few students (usually only 2% to 3%) consistently had strongly negative opinions about all aspects of the subject. Since these results seem slightly more supportive than students' liking of the subject alone, it may be that students understand the utility of mathematics to a greater extent than they actually like doing it.

Gender differences for the index of overall attitudes are portrayed in Figure 4.4. In many countries, girls and boys reported similar overall attitudes about mathematics. The countries where boys' attitudes were significantly more positive than those of girls included Austria, France, Germany, Greece, Hong Kong, Japan, the Netherlands, Norway, Sweden, and Switzerland. Interestingly, the index of overall attitudes towards mathematics showed gender differences in a somewhat different set of countries than the single question about liking mathematics. For the countries showing a gender difference on the attitudes index but not on the liking question, it is possible that boys more than girls perceive the relevance of mathematics.

Table 4.14

Students' Reports on How Much They Like Mathematics
Upper Grade (Eighth Grade*)

Country	Dislike a Lot		Dislike		Like		Like a Lot	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	12 (0.6)	480 (5.2)	24 (0.7)	523 (4.8)	51 (0.7)	541 (4.1)	13 (0.7)	563 (5.0)
Austria	16 (1.0)	517 (6.2)	26 (1.1)	529 (4.7)	41 (1.1)	548 (3.6)	17 (1.2)	558 (6.3)
Belgium (Fl)	11 (0.8)	520 (7.3)	21 (1.0)	558 (4.9)	49 (1.1)	566 (6.7)	18 (1.1)	602 (6.2)
Belgium (Fr)	11 (1.2)	489 (8.2)	19 (1.0)	514 (5.7)	48 (1.1)	529 (3.9)	22 (1.2)	557 (7.1)
Canada	10 (0.5)	498 (4.7)	16 (0.7)	521 (3.6)	54 (1.1)	527 (2.9)	20 (0.9)	553 (3.4)
Colombia	8 (0.6)	367 (6.9)	14 (1.1)	378 (3.9)	55 (1.3)	388 (3.1)	23 (1.4)	392 (6.6)
Cyprus	14 (0.9)	423 (3.5)	13 (0.5)	449 (4.3)	46 (1.0)	473 (2.7)	28 (1.0)	515 (3.4)
Czech Republic	14 (0.8)	533 (6.0)	36 (1.2)	550 (5.4)	41 (1.4)	578 (6.0)	8 (0.6)	606 (8.0)
Denmark	5 (0.6)	480 (7.9)	17 (1.1)	477 (4.3)	46 (1.2)	503 (4.0)	32 (1.5)	522 (3.9)
England	5 (0.5)	473 (8.5)	15 (1.0)	499 (6.5)	56 (1.2)	507 (3.2)	24 (1.1)	518 (4.6)
France	12 (1.0)	506 (5.7)	20 (1.1)	524 (4.6)	51 (1.3)	544 (3.3)	17 (1.0)	566 (5.5)
Germany	23 (1.2)	481 (4.8)	22 (1.1)	508 (6.8)	31 (1.1)	525 (5.0)	24 (1.1)	522 (5.7)
Greece	11 (0.6)	453 (5.0)	15 (0.6)	468 (4.3)	49 (1.0)	480 (3.4)	25 (1.0)	517 (3.6)
Hong Kong	12 (0.8)	545 (10.1)	23 (0.9)	569 (7.0)	48 (1.0)	598 (6.1)	17 (0.9)	629 (6.5)
Hungary	12 (0.8)	496 (7.4)	30 (1.2)	522 (4.3)	47 (1.1)	549 (3.8)	11 (0.7)	589 (6.1)
Iceland	6 (0.9)	447 (15.0)	15 (1.1)	480 (5.9)	56 (1.7)	488 (4.7)	23 (1.5)	503 (5.5)
Iran, Islamic Rep.	7 (0.6)	407 (5.2)	8 (0.7)	412 (5.2)	47 (1.5)	421 (2.8)	38 (1.5)	446 (2.8)
Ireland	9 (0.7)	492 (7.1)	18 (1.0)	520 (5.4)	53 (1.2)	531 (5.1)	21 (1.1)	549 (8.0)
Israel	10 (1.3)	513 (9.8)	24 (1.4)	523 (8.2)	45 (1.7)	522 (5.5)	21 (1.3)	536 (8.5)
Japan	11 (0.7)	550 (4.1)	36 (1.0)	585 (2.6)	43 (1.0)	625 (2.3)	10 (0.5)	649 (4.1)
Korea	6 (0.3)	536 (8.0)	36 (1.2)	569 (3.6)	44 (1.2)	628 (3.3)	14 (0.8)	676 (5.0)
Kuwait	8 (1.5)	371 (6.2)	8 (0.9)	391 (5.1)	40 (1.9)	391 (3.0)	44 (2.5)	398 (3.5)
Latvia (LSS)	7 (0.7)	469 (6.2)	26 (1.2)	475 (4.2)	56 (1.3)	499 (3.6)	11 (0.8)	536 (5.8)
Lithuania	12 (0.8)	457 (6.1)	35 (1.3)	463 (4.1)	44 (1.4)	488 (4.1)	9 (0.7)	519 (8.7)
Netherlands	13 (1.8)	494 (17.1)	30 (1.3)	535 (7.5)	50 (1.8)	554 (6.2)	8 (0.8)	567 (9.2)
New Zealand	9 (0.6)	475 (6.0)	19 (0.8)	500 (4.9)	51 (0.9)	508 (5.0)	21 (0.9)	533 (6.1)
Norway	11 (0.7)	454 (3.9)	26 (0.9)	485 (3.3)	47 (1.0)	514 (2.9)	16 (0.7)	540 (4.2)
Portugal	10 (0.7)	421 (3.8)	19 (1.0)	439 (3.4)	53 (1.0)	456 (2.5)	18 (1.1)	485 (4.0)
Romania	11 (0.7)	458 (7.3)	18 (0.7)	460 (5.4)	52 (1.0)	483 (4.1)	19 (1.0)	516 (5.6)
Russian Federation	5 (0.5)	499 (8.9)	22 (1.0)	510 (7.2)	58 (1.2)	540 (5.4)	15 (0.8)	574 (5.1)
Scotland	7 (0.6)	458 (6.4)	19 (0.9)	493 (5.3)	57 (1.0)	498 (6.0)	17 (1.0)	529 (9.8)
Singapore	4 (0.4)	583 (8.8)	14 (0.7)	613 (6.4)	54 (0.9)	642 (4.8)	28 (1.1)	671 (5.5)
Slovak Republic	15 (0.6)	496 (4.4)	25 (1.0)	526 (4.2)	49 (1.1)	559 (3.7)	11 (0.7)	613 (4.5)
Slovenia	11 (1.0)	511 (6.7)	23 (1.1)	519 (4.5)	52 (1.5)	540 (3.5)	14 (0.8)	606 (4.7)
Spain	13 (0.8)	459 (3.6)	24 (0.8)	473 (3.0)	45 (0.9)	491 (2.5)	18 (0.8)	516 (3.6)
Sweden	11 (0.7)	479 (4.9)	29 (1.0)	510 (3.2)	48 (1.1)	526 (3.3)	13 (0.7)	547 (5.1)
Switzerland	10 (0.7)	508 (7.0)	22 (1.1)	543 (4.1)	48 (0.9)	549 (3.2)	20 (0.8)	563 (4.6)
Thailand	3 (0.4)	502 (11.6)	15 (1.1)	504 (5.8)	59 (1.3)	519 (5.5)	23 (1.5)	548 (7.9)
United States	12 (0.7)	463 (5.2)	17 (0.7)	492 (5.2)	47 (0.8)	504 (4.8)	23 (1.0)	519 (6.1)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

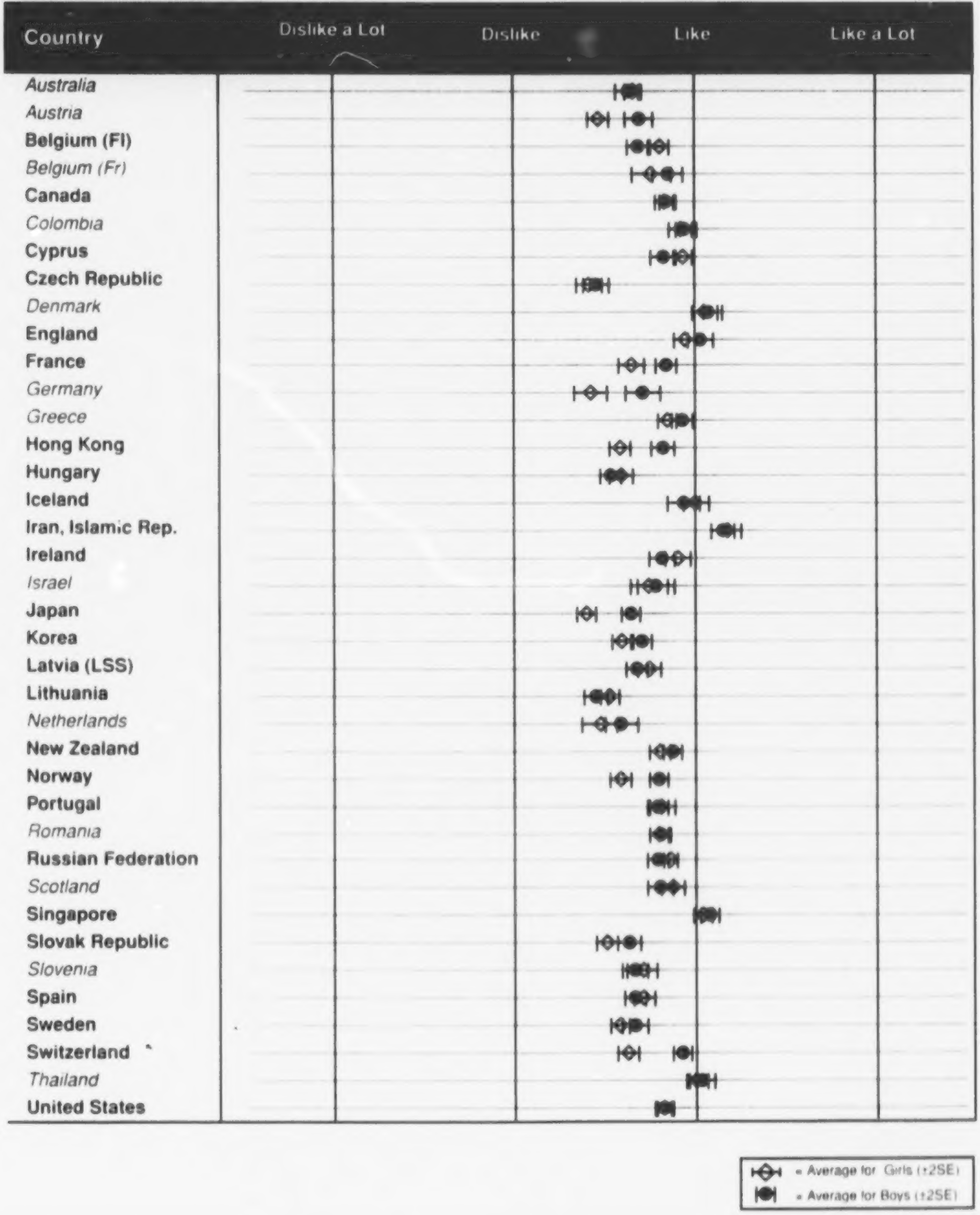
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 4.3

Gender Differences in Liking Mathematics
Upper Grade (Eighth Grade*)



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*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 4.15

Students' Overall Attitudes[1] Towards Mathematics Upper Grade (Eighth Grade*)

Country	Strongly Negative		Negative		Positive		Strongly Positive	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	4 (0.3)	492 (8.3)	32 (0.9)	514 (4.5)	55 (0.8)	540 (4.3)	9 (0.6)	561 (5.9)
Austria	4 (0.5)	527 (11.1)	38 (1.1)	532 (4.1)	47 (0.9)	542 (3.5)	12 (0.9)	560 (7.4)
Belgium (Fl)	4 (0.5)	535 (10.7)	33 (1.1)	547 (5.2)	52 (1.2)	572 (6.4)	11 (0.9)	604 (8.8)
Belgium (Fr)	3 (0.5)	507 (10.0)	28 (1.3)	514 (5.4)	53 (1.4)	526 (4.0)	15 (0.9)	558 (5.4)
Canada	3 (0.3)	510 (9.1)	23 (0.8)	512 (3.5)	58 (0.7)	528 (2.7)	16 (0.7)	554 (3.3)
Colombia	1 (0.5)	~ ~	11 (1.2)	387 (8.2)	61 (1.5)	385 (3.7)	26 (1.2)	387 (5.9)
Cyprus	2 (0.4)	~ ~	19 (1.1)	435 (3.3)	53 (0.9)	471 (2.6)	26 (1.0)	513 (3.8)
Czech Republic	3 (0.3)	543 (10.4)	39 (1.4)	544 (6.1)	52 (1.4)	574 (5.6)	6 (0.6)	613 (10.1)
Denmark	1 (0.2)	~ ~	16 (1.1)	479 (4.8)	57 (1.3)	502 (3.5)	26 (1.4)	523 (4.7)
England	1 (0.3)	~ ~	17 (1.0)	497 (5.9)	64 (1.1)	509 (3.0)	18 (1.0)	514 (6.0)
France	3 (0.5)	520 (7.7)	27 (1.5)	518 (4.5)	54 (1.1)	543 (3.2)	16 (1.0)	564 (5.7)
Germany	5 (0.5)	498 (8.0)	38 (1.4)	498 (5.2)	43 (1.1)	518 (5.3)	13 (0.8)	521 (6.3)
Greece	2 (0.3)	~ ~	21 (0.8)	467 (3.9)	57 (0.9)	482 (3.7)	20 (0.8)	512 (3.7)
Hong Kong	3 (0.4)	530 (16.4)	31 (1.0)	561 (7.8)	57 (1.1)	601 (6.1)	9 (0.6)	640 (6.6)
Hungary	2 (0.3)	~ ~	38 (1.2)	518 (4.1)	53 (1.3)	547 (3.7)	7 (0.6)	592 (7.2)
Iceland	2 (0.5)	~ ~	24 (1.6)	478 (5.5)	59 (1.5)	489 (4.9)	14 (1.2)	499 (6.5)
Iran, Islamic Rep.	2 (0.3)	~ ~	15 (1.2)	409 (3.1)	54 (1.6)	426 (2.7)	30 (1.3)	446 (2.9)
Ireland	2 (0.3)	~ ~	26 (1.1)	515 (5.3)	59 (1.2)	530 (5.3)	13 (0.9)	551 (8.1)
Israel	2 (0.5)	~ ~	25 (1.9)	523 (7.9)	56 (1.7)	524 (6.4)	17 (1.4)	527 (8.8)
Japan	4 (0.4)	558 (7.1)	44 (1.2)	592 (2.7)	48 (1.3)	619 (2.0)	3 (0.2)	649 (8.7)
Korea	2 (0.2)	~ ~	48 (1.1)	581 (3.0)	46 (1.1)	630 (3.4)	5 (0.4)	680 (9.9)
Kuwait	3 (0.5)	372 (8.3)	15 (1.5)	385 (4.2)	48 (1.5)	390 (3.1)	34 (2.2)	400 (3.0)
Latvia (LSS)	1 (0.2)	~ ~	28 (1.3)	478 (4.1)	62 (1.3)	496 (3.7)	8 (0.7)	526 (5.9)
Lithuania	2 (0.4)	~ ~	38 (1.3)	467 (3.9)	53 (1.4)	480 (4.1)	7 (0.6)	513 (9.3)
Netherlands	4 (0.5)	506 (14.7)	40 (1.9)	526 (9.1)	50 (1.8)	554 (6.2)	6 (0.8)	570 (10.6)
New Zealand	2 (0.3)	~ ~	23 (0.9)	491 (4.4)	60 (0.9)	511 (5.0)	15 (0.8)	530 (6.4)
Norway	3 (0.3)	456 (8.3)	30 (0.9)	481 (2.9)	55 (0.8)	511 (2.7)	12 (0.7)	538 (4.6)
Portugal	2 (0.3)	~ ~	24 (1.2)	436 (3.0)	58 (1.0)	456 (2.5)	16 (1.1)	480 (3.9)
Romania	1 (0.1)	~ ~	25 (1.0)	465 (5.7)	60 (1.0)	480 (4.2)	15 (0.9)	520 (6.2)
Russian Federation	1 (0.2)	~ ~	24 (1.1)	512 (5.4)	63 (1.2)	538 (6.1)	12 (0.8)	570 (5.5)
Scotland	7 (0.6)	458 (6.4)	19 (0.9)	493 (5.3)	57 (1.0)	498 (6.0)	17 (1.0)	529 (9.8)
Singapore	1 (0.2)	~ ~	16 (0.8)	609 (6.2)	62 (0.9)	646 (4.9)	20 (1.0)	666 (5.7)
Slovak Republic	1 (0.3)	~ ~	30 (1.0)	516 (3.7)	60 (1.0)	556 (3.7)	9 (0.6)	601 (5.4)
Slovenia	3 (0.4)	535 (11.2)	33 (1.3)	519 (3.7)	57 (1.4)	546 (3.5)	8 (0.7)	601 (6.8)
Spain	3 (0.4)	459 (5.9)	33 (1.0)	474 (2.8)	52 (1.0)	491 (2.2)	13 (0.8)	513 (4.3)
Sweden	2 (0.3)	~ ~	33 (1.1)	503 (3.3)	55 (0.9)	523 (3.2)	10 (0.7)	553 (5.0)
Switzerland	3 (0.3)	532 (9.2)	28 (1.1)	540 (4.1)	53 (1.2)	549 (3.0)	16 (0.6)	554 (5.5)
Thailand	0 (0.1)	~ ~	12 (1.1)	503 (7.3)	72 (1.0)	520 (5.3)	16 (1.2)	551 (9.1)
United States	4 (0.3)	481 (7.5)	26 (0.9)	483 (5.0)	55 (1.0)	503 (4.8)	15 (0.7)	526 (6.8)

[1] Index of overall attitudes towards mathematics is based on average of responses to the following statements: 1) I would like a job that involved using mathematics; 2) Mathematics is important to everyone's life; 3) Mathematics is boring (reversed scale); 4) I enjoy learning mathematics; 5) I like mathematics.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

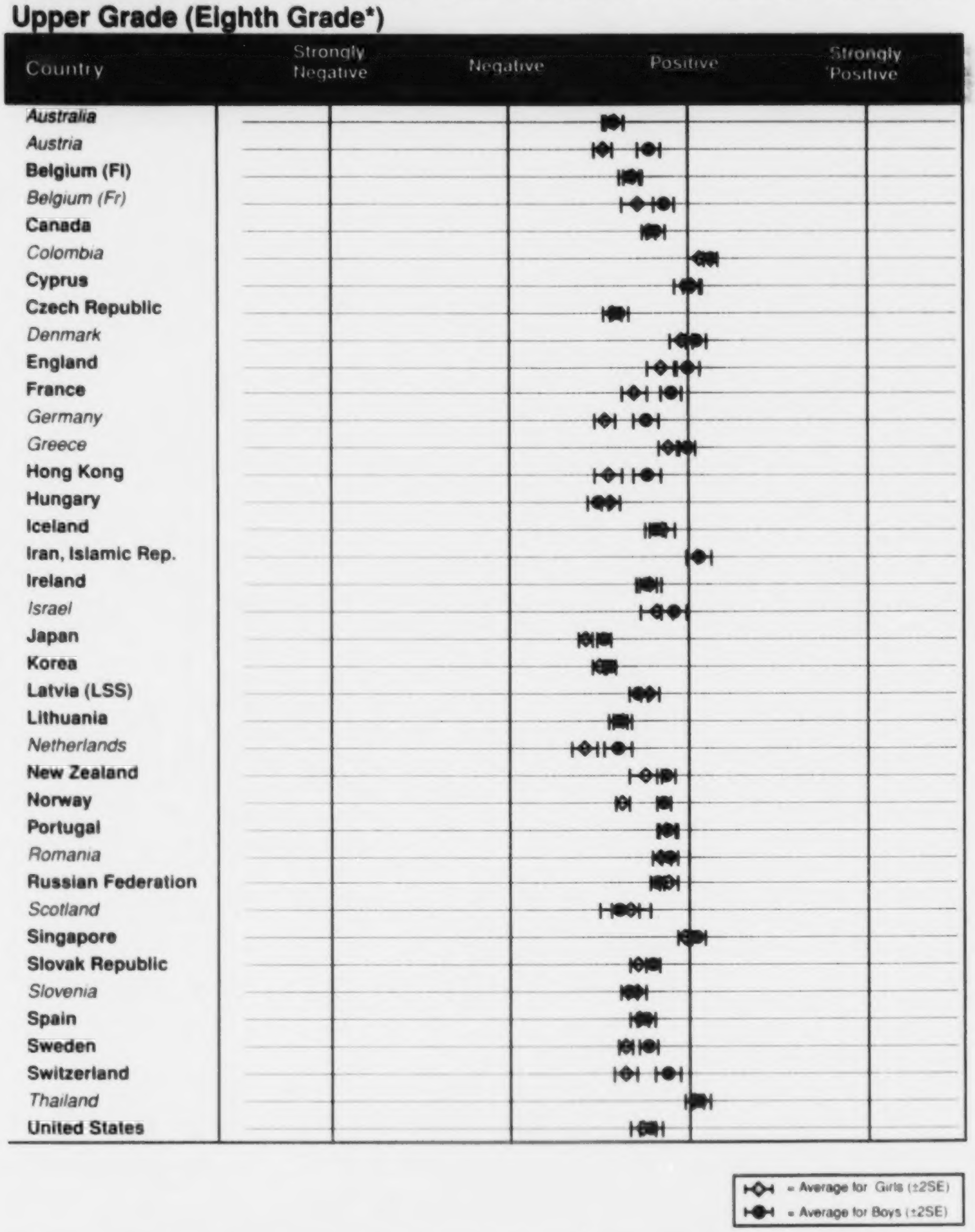
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 4.4

Gender Differences in Students' Overall Attitudes[1] Towards Mathematics Upper Grade (Eighth Grade*)



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[1] Index of overall attitudes towards mathematics is based on average of responses to the following statements: 1) I would like a job that involved using mathematics; 2) Mathematics is important to everyone's life; 3) Mathematics is boring (reversed scale); 4) I enjoy learning mathematics; 5) I like mathematics.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable. Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Chapter 5

TEACHERS AND INSTRUCTION

Teachers and the instructional approaches they use are fundamental in building students' mathematical understanding. Primary among their many duties and responsibilities, teachers structure and guide the pace of individual, small-group, and whole-class work to present new material, engage students in mathematical tasks, and help deepen students' grasp of the mathematics being studied. Teachers may help students use technology and tools to investigate mathematical ideas, analyze students' work for misconceptions, and promote positive attitudes about mathematics. They also may assign homework and conduct informal as well as formal assessments to monitor progress in student learning, make ongoing instructional decisions, and evaluate achievement outcomes.

Effective teaching is a complex endeavor requiring knowledge about the subject matter of mathematics, the ways students learn, and effective pedagogy in mathematics. It can be fostered through institutional support and adequate resources. Teachers also can support each other in planning instructional strategies, devising real-world applications of mathematical concepts, and developing sequences that move students from concrete tasks to the ability to think for themselves and explore mathematical theories.

TIMSS administered a background questionnaire to teachers to gather information about their backgrounds, training, and how they think about mathematics. The questionnaire also asked about how they spend their time related to their teaching tasks and the instructional approaches they use in their classrooms. Information was collected about the materials used in instruction, the activities students do in class, the use of calculators and computers in mathematics lessons, the role of homework, and the reliance on different types of assessment approaches.

This chapter presents the results of teachers' responses to some of these questions. Because the sampling for the teacher questionnaires was based on participating students, the responses to the mathematics teacher questionnaire do not necessarily represent all of the eighth-grade mathematics teachers in each of the TIMSS countries. Rather, they represent teachers of the representative samples of students assessed. It is important to note that in this report, the student is always the unit of analysis, even when information from the teachers' questionnaires is being reported. Using the student as the unit of analysis makes it possible to describe the instruction received by representative samples of students. Although this approach may provide a different perspective from that obtained by simply collecting information from teachers, it is consistent with the TIMSS goals of providing information about the educational contexts and performance of students.

Because countries were required to sample two classes (from adjacent grades), it was possible for an individual to be the mathematics or science teacher of both classes. In order to keep the response burden for teachers to a minimum, no teacher was asked to respond to more than one questionnaire, even where that teacher taught mathematics or science to more than one of the sampled classes. This, together with the fact that teachers sometimes did not complete the questionnaire assigned to them, meant that each country had some percentage of students for whom no teacher questionnaire information was available. The tables in this chapter contain special notation regarding the availability of teacher responses. For a country where teacher responses are available for 70% to 84% of the students, an "r" is included next to the data for that country. When teacher responses are available for 50% to 69% of the students, an "s" is included next to the data for that country. When teacher responses are available for less than 50% of the students, an "x" replaces the data.[1]

WHO DELIVERS MATHEMATICS INSTRUCTION?

This section provides information about the mathematics teaching force in each of the participating countries, in terms of certification, degrees, age, gender, and years of teaching experience.

Table 5.1 summarizes information gathered from each country about the requirements for certification held by the majority of the seventh- and eighth-grade teachers. In many countries, the type of education required for qualification includes a university degree. In other countries, study at a teacher training institution is required, or even both a university degree and study at a teacher training institution. The number of years of post secondary education required for a teaching qualification ranged from two years in Iran to as much as six years in Canada, although many countries reported four years. All of the countries except Colombia, Cyprus, Greece, and Lithuania reported that teaching practice was required. A large number of countries reported that an evaluation or examination was required for certification. Those countries not having such a requirement included Canada, Colombia, Cyprus, Greece, Iran, Israel, Korea, Portugal, and the United States.

Table 5.2 contains teachers' reports on their age and gender. If a constant supply of teachers were entering the teaching force, devoting their careers to the classroom, and then retiring, one might expect approximately equivalent percentages of students taught by teachers in their 20s, 30s, 40s, and 50s. However, this does not appear to hold for most countries. In most countries, the majority of the eighth-grade students were taught by teachers in their 30s or 40s. Very few countries seemed to have a comparatively younger teaching force, but those that did included Hong Kong, Iran, Kuwait, and Portugal. In these four countries, 40% or more of the students had mathematics teachers 29 years or younger and 70% had teachers in their 30s or younger. According to teachers' reports, the teaching force in eighth-grade mathematics was comparatively older in a number of countries. The TIMSS participants where 70% or more of the eighth-grade students had mathematics teachers in their 40s or older included the Czech Republic, Denmark, France, Germany, Norway, Romania, the Slovak Republic, and Spain.

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[1] Similar to Chapter 4, background data are not available for Bulgaria and South Africa.

In about one-fourth of the countries, approximately equivalent percentages of eighth-grade students were taught mathematics by male teachers and female teachers. However, at least 70% of the eighth-grade students had female mathematics teachers in the Czech Republic, Hungary, Israel, Latvia (LSS), Lithuania, the Russian Federation, the Slovak Republic, and Slovenia. In contrast, at least 70% of the students had male teachers in Greece, Japan, the Netherlands, and Switzerland.

As might be expected from the differences in teachers' ages from country to country, the TIMSS data indicate differences in teachers' longevity across countries (see Table 5.3). Those countries with younger teaching forces tended to have more students taught by less experienced teachers. At least half the eighth-grade students had mathematics teachers with 10 years or less of experience in Hong Kong, Iran, Korea, Kuwait, Portugal, and Thailand. In contrast, at least half the students had mathematics teachers with more than 20 years of experience in Belgium (French), the Czech Republic, France, Romania, the Slovak Republic, and Spain.

The relationship between years of teaching experience and mathematics achievement was not consistent across countries. In about one-fourth of the countries, the eighth-grade students with the most experienced teachers (more than 20 years) had higher mathematics achievement than did those with less experienced teachers (5 years or fewer). This may reflect the practice of giving teachers with more seniority the more advanced classes. However, in several countries, this pattern of higher student performance for the more experienced teachers was reversed. For another one-fourth of the countries or so, there was essentially no difference in student performance in relation to years of teaching experience. For the remaining countries, there were inconsistent patterns of performance differences in relation to years of teaching experience.

Table 5.1

Requirements for Certification Held by the Majority of Lower- and Upper-Grade (Seventh and Eighth Grade*) Teachers[1]

Country	Type of Education Required for Qualification	Number of Years of Post-Secondary Education Required	Teaching or Practice Experience Required	Evaluation or Examination Required
Australia	**University or Teacher Training Institution**	**4**	**yes**	**yes**
Austria	Teacher Training Institution: Teachers in the general secondary schools (70%) are required to have an education from a teacher training institution. Teachers in the academic secondary schools (30%) are required to have a university education.	3–5	yes	yes
Belgium (Fl)	Teacher Training Institution	3	yes	yes
Belgium (Fr)	Teacher Training Institution	3	yes	yes
Bulgaria	University	5	yes	yes
Canada	University	5–6	yes	no
Colombia	University	4	no	no
Cyprus	University	4	no	no
Czech Republic	University	4–5	yes	yes
Denmark	Teacher Training Institution	4	yes	yes
England	University or Higher Education Institution: Teachers of lower- and upper-grade students normally study their specialist subject area for their degree for 3 or 4 years. This is followed by a one-year post graduate course. However, some teachers study education and specialty concurrently. All teachers who qualified since 1975 are graduates. Some teachers who qualified before this date hold teacher certificates but are not graduates.	3–5	yes	yes
France	University and Teacher Training: As of 1991, teachers of lower- and upper-grade students are required to have a 3-year university diploma, followed by a competitive examination and professional training. The majority of teachers (more than 50%) meet the requirements (more in the public schools than in the private sector). Yet, there are still many teachers recruited before 1991 who do not have the same level of qualification.	4 or 5	yes	yes
Germany	University and Post-University Teacher Training Institution	3–5 +2 years	yes	yes
Greece	University	4	no	no
Hong Kong	University and one year Post-Graduate training	4	yes	yes
Hungary	Teacher Training Institution	4	yes	yes
Iceland	University	3	yes	yes
Iran	Teacher Training Institution	2	yes	no
Ireland	University with Post Graduate University Training	4–5	yes	yes
Israel	University	4	yes	no
Japan	University	4	yes	yes

*Seventh and eighth grades in most countries; see Table 2 for more information about the grades tested in each country.

[1] Certification pertains to the majority (more than 50%) of teachers of lower- and upper-grade students in each country.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Information provided by TIMSS National Research Coordinators.

Table 5.1 (Continued)

Requirements for Certification Held by the Majority of Lower- and Upper-Grade (Seventh and Eighth Grade*) Teachers[1]

Country	Type of Education Required for Qualification	Number of Years of Post-Secondary Education Required	Teaching or Practice Experience Required	Evaluation or Examination Required
Korea	University	4	yes	no
Kuwait	University	4	yes	yes
Latvia	Pedagogical Institution	4	yes	yes
Lithuania	University or Teacher Training Institution	5	no	yes
Netherlands	Teacher Training Institution	4	yes	yes
New Zealand	Teacher Training Institution or University with Teacher Training Institution: Teachers of students in the lower grade are required to attend a teacher training institution. Teachers in the upper grade are required to have a university and teacher training institution education.	3 (lower gr.) 4 (upper gr.)	yes	yes
Norway	Teacher Training Institution or University: Most teachers of students in the lower grade have a certificate from a teacher training institution. For teachers of students in the upper grade there is about an equal distribution between those who attended a teacher training institution and those who attended university.	3–4[2]	yes	yes
Philippines	Teacher Training Institution or University	4	yes	yes
Portugal	University	3–5	yes	no
Romania	University	4–5	yes	yes
Russian Federation	University or Teacher Training Institution or Post-Graduate University Training	4–5	yes	yes
Scotland	University or Teacher Training Institution	4	yes	yes
Singapore	Post-Graduate University Training	4–5	yes	yes
Slovak Republic	Teacher Training Institution or University	4–5[3]	yes	yes
Slovenia	University	4–5	yes	yes
South Africa	Teacher Training Institution	3	yes	yes
Spain	Teacher Training Institution or University	3	yes	yes
Sweden	Teacher Training Institution (lower grade) University (upper grade)	3-3.5 (lower gr.)[4] 4-4.5 (upper gr.)	yes	yes
Switzerland	University or Teacher Training Institution	2–4	yes	yes
Thailand	Teacher Training Institution or University	4	yes	yes
United States	University	4	yes	no

*Seventh and eighth grades in most countries; see Table 2 for more information about the grades tested in each country.

[1] Certification pertains to the majority (more than 50%) of teachers of lower- and upper-grade students in each country.

[2] Norway: Until 1965 2 years of post-secondary education were required. Between 1965 and 1995 3 years were required. As of 1996, new certified teachers are required to have completed 4 years of post-secondary education.

[3] Slovak Republic: In the past, 4 years of study at a teacher training institution were required. Currently, the requirement is 5 years at a teacher training institution or university.

[4] Sweden: Until 1988 3 years of post-secondary education were required for lower-grade teachers and 4 years for upper-grade teachers. Since 1988 3.5 years of post-secondary education are required for lower-grade teachers and 4-4.5 years are required for upper-grade teachers.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95. Information provided by TIMSS National Research Coordinators.

Table 5.2

Teachers' Reports on Their Age and Gender
Mathematics - Upper Grade (Eighth Grade*)

Country	Percent of Students Taught by Teachers				Percent of Students Taught by Teachers	
	29 Years or Under	30 - 39 Years	40 - 49 Years	50 Years or Older	Female	Male
Australia	22 (2.6)	27 (3.2)	41 (3.3)	10 (1.9)	44 (3.3)	56 (3.3)
Austria	r 9 (2.6)	38 (3.8)	42 (4.6)	10 (2.7)	r 48 (4.4)	52 (4.4)
Belgium (Fl)	13 (3.1)	28 (4.2)	30 (4.2)	29 (4.9)	66 (4.3)	34 (4.3)
Belgium (Fr)	s 5 (2.3)	26 (5.0)	46 (6.0)	23 (5.1)	s 51 (5.5)	49 (5.5)
Canada	15 (2.4)	21 (3.1)	39 (3.9)	26 (3.2)	38 (4.3)	62 (4.3)
Colombia	23 (4.4)	25 (4.1)	40 (4.5)	12 (2.9)	34 (4.2)	66 (4.2)
Cyprus	0 (0.0)	38 (4.7)	47 (5.2)	15 (3.5)	r 61 (5.6)	39 (5.6)
Czech Republic	8 (2.4)	20 (3.6)	41 (4.7)	31 (4.8)	82 (3.2)	18 (3.2)
Denmark	2 (1.4)	22 (4.0)	52 (4.7)	24 (4.0)	35 (4.5)	65 (4.5)
England	s 17 (2.5)	23 (3.1)	43 (2.8)	17 (2.4)	s 45 (3.6)	55 (3.6)
France	11 (2.7)	17 (3.7)	48 (5.0)	24 (3.8)	43 (4.5)	57 (4.5)
Germany	s 0 (0.0)	13 (3.5)	36 (5.2)	51 (5.3)	s 33 (4.9)	67 (4.9)
Greece	0 (0.4)	33 (4.4)	54 (4.2)	12 (4.2)	30 (3.8)	70 (3.8)
Hong Kong	48 (6.1)	29 (5.1)	11 (3.7)	12 (3.8)	40 (5.2)	60 (5.2)
Hungary	10 (2.5)	31 (4.4)	42 (4.4)	18 (3.1)	87 (3.1)	13 (3.1)
Iceland	r 12 (4.9)	39 (7.0)	29 (6.0)	20 (6.9)	r 39 (5.6)	61 (5.6)
Iran, Islamic Rep.	44 (4.8)	36 (5.1)	17 (3.0)	2 (1.6)	37 (4.8)	63 (4.8)
Ireland	17 (3.6)	34 (4.3)	35 (4.1)	14 (3.1)	58 (4.0)	42 (4.0)
Israel	r 12 (4.8)	27 (7.3)	41 (7.8)	20 (6.3)	r 95 (2.4)	5 (2.4)
Japan	22 (3.2)	43 (3.7)	25 (3.5)	10 (2.5)	28 (3.8)	72 (3.8)
Korea	26 (3.7)	43 (4.4)	12 (3.2)	19 (3.0)	45 (3.9)	55 (3.9)
Kuwait	40 (8.1)	40 (7.6)	16 (3.5)	3 (2.8)	51 (7.8)	49 (7.8)
Latvia (LSS)	15 (3.5)	41 (5.1)	20 (3.8)	24 (4.2)	90 (2.8)	10 (2.8)
Lithuania	8 (2.3)	36 (4.1)	22 (3.5)	34 (4.4)	87 (2.6)	13 (2.6)
Netherlands	6 (2.5)	33 (5.2)	50 (5.2)	11 (2.9)	22 (4.1)	78 (4.1)
New Zealand	12 (2.5)	38 (4.2)	35 (3.8)	15 (3.3)	42 (4.1)	58 (4.1)
Norway	7 (2.1)	23 (3.8)	39 (4.1)	31 (3.5)	32 (3.9)	68 (3.9)
Portugal	45 (4.5)	35 (4.1)	14 (2.2)	6 (2.2)	68 (3.8)	32 (3.8)
Romania	11 (2.4)	18 (3.1)	41 (4.3)	30 (4.0)	64 (4.0)	36 (4.0)
Russian Federation	18 (3.6)	29 (3.3)	33 (3.1)	21 (3.2)	97 (1.2)	3 (1.2)
Scotland	14 (3.3)	28 (4.4)	40 (4.9)	18 (3.2)	45 (4.6)	55 (4.6)
Singapore	26 (4.1)	18 (3.2)	33 (4.6)	23 (3.8)	60 (4.5)	40 (4.5)
Slovak Republic	7 (2.0)	22 (3.6)	50 (4.7)	22 (3.7)	79 (3.9)	21 (3.9)
Slovenia	r 9 (3.0)	59 (4.9)	22 (4.4)	10 (2.5)	r 87 (3.6)	13 (3.6)
Spain	0 (0.4)	24 (3.6)	48 (4.3)	28 (3.7)	37 (4.1)	63 (4.1)
Sweden	10 (2.2)	22 (3.5)	27 (3.2)	41 (4.3)	33 (3.3)	67 (3.3)
Switzerland	10 (3.5)	27 (3.9)	37 (4.4)	25 (3.9)	13 (2.3)	87 (2.3)
Thailand	r 25 (5.0)	43 (6.2)	29 (6.2)	3 (2.3)	r 61 (6.2)	39 (6.2)
United States	17 (3.0)	19 (3.2)	44 (4.4)	19 (2.9)	65 (4.0)	35 (4.0)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.3

Teachers' Reports on Their Years of Teaching Experience Mathematics - Upper Grade (Eighth Grade*)

Country	0 - 5 Years		6-10 Years		11-20 Years		More than 20 Years	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	18 (2.3)	517 (8.5)	19 (2.6)	528 (11.6)	35 (2.7)	540 (8.5)	28 (2.6)	533 (8.5)
Austria	r 7 (2.3)	516 (19.7)	13 (2.5)	546 (9.5)	51 (4.0)	554 (6.7)	28 (3.6)	549 (8.8)
Belgium (Fl)	10 (2.8)	556 (17.9)	9 (2.2)	590 (14.5)	32 (4.8)	554 (13.4)	49 (4.9)	575 (10.6)
Belgium (Fr)	s 8 (3.2)	536 (12.3)	8 (2.3)	528 (13.8)	31 (5.2)	558 (7.0)	54 (4.8)	543 (6.4)
Canada	17 (2.6)	527 (6.7)	15 (2.9)	527 (5.0)	22 (3.6)	526 (7.6)	46 (3.8)	528 (3.8)
Colombia	18 (3.0)	409 (7.7)	22 (5.0)	375 (11.7)	27 (4.3)	385 (6.0)	33 (4.2)	385 (5.0)
Cyprus	r 30 (4.6)	474 (4.6)	19 (4.3)	474 (7.6)	25 (5.0)	467 (6.4)	26 (4.7)	471 (5.5)
Czech Republic	12 (3.1)	566 (17.7)	9 (1.9)	538 (8.6)	17 (4.1)	584 (11.4)	62 (4.7)	562 (5.7)
Denmark	4 (1.9)	487 (2.6)	4 (2.0)	493 (14.4)	47 (4.9)	504 (3.3)	45 (4.8)	508 (4.4)
England	s 19 (2.5)	522 (10.8)	11 (2.1)	518 (13.5)	39 (3.5)	512 (8.1)	31 (3.0)	515 (11.3)
France	11 (2.5)	539 (8.1)	11 (3.1)	529 (10.2)	26 (4.6)	540 (8.8)	52 (4.3)	538 (5.4)
Germany	s 10 (2.2)	534 (14.5)	14 (4.3)	471 (12.1)	32 (5.1)	521 (10.6)	44 (5.5)	516 (9.3)
Greece	16 (3.1)	464 (7.2)	20 (3.4)	469 (5.3)	47 (4.3)	490 (3.5)	17 (4.4)	503 (11.9)
Hong Kong	53 (5.9)	585 (9.7)	14 (3.3)	606 (16.3)	18 (4.2)	574 (19.2)	15 (3.9)	596 (19.8)
Hungary	13 (2.9)	530 (12.7)	10 (2.8)	510 (7.4)	38 (4.1)	537 (5.6)	38 (4.1)	547 (5.2)
Iceland	r 19 (5.1)	478 (5.3)	14 (3.8)	480 (8.5)	33 (7.1)	492 (7.3)	35 (7.7)	496 (10.6)
Iran, Islamic Rep.	38 (4.5)	417 (3.7)	24 (4.8)	437 (3.8)	24 (4.3)	433 (3.2)	14 (3.0)	440 (4.8)
Ireland	13 (3.0)	513 (16.3)	18 (3.5)	512 (12.5)	42 (4.5)	535 (8.4)	28 (4.5)	523 (10.0)
Israel	r 16 (6.1)	490 (9.1)	12 (4.3)	555 (15.9)	45 (7.4)	510 (8.3)	27 (7.4)	548 (13.7)
Japan	19 (3.3)	606 (5.0)	25 (3.5)	607 (4.3)	36 (3.8)	598 (3.5)	19 (2.9)	614 (4.0)
Korea	28 (3.5)	610 (4.7)	29 (3.9)	622 (5.6)	23 (3.7)	597 (5.6)	20 (3.1)	606 (5.5)
Kuwait	r 30 (6.7)	397 (3.3)	33 (5.5)	388 (3.4)	31 (7.0)	388 (4.1)	6 (4.1)	418 (8.5)
Latvia (LSS)	12 (3.4)	496 (7.0)	16 (3.4)	482 (8.8)	38 (5.0)	496 (5.5)	34 (5.1)	490 (5.8)
Lithuania	r 5 (1.8)	455 (9.2)	15 (3.3)	465 (11.0)	33 (4.2)	482 (8.4)	47 (4.3)	481 (5.2)
Netherlands	13 (3.6)	530 (19.5)	21 (3.6)	525 (10.2)	42 (5.3)	548 (17.8)	24 (4.0)	556 (9.3)
New Zealand	17 (3.1)	497 (7.5)	28 (4.0)	515 (7.9)	34 (4.1)	517 (9.2)	20 (3.4)	487 (9.4)
Norway	12 (2.7)	499 (10.7)	10 (2.5)	500 (6.1)	35 (4.0)	508 (4.0)	43 (4.6)	503 (3.4)
Portugal	51 (4.7)	449 (3.0)	16 (3.1)	447 (5.4)	27 (3.9)	462 (4.3)	6 (2.3)	477 (8.6)
Romania	10 (2.3)	452 (14.2)	15 (3.1)	466 (9.9)	14 (3.1)	496 (12.8)	61 (4.2)	486 (5.7)
Russian Federation	16 (3.7)	541 (25.2)	14 (2.5)	532 (9.7)	29 (4.0)	526 (7.1)	41 (5.0)	538 (6.6)
Scotland	17 (3.4)	483 (9.2)	12 (3.2)	484 (14.3)	42 (4.4)	496 (8.5)	29 (4.3)	507 (12.3)
Singapore	30 (4.5)	617 (9.4)	11 (2.8)	658 (14.0)	11 (3.0)	664 (13.4)	48 (4.6)	652 (7.0)
Slovak Republic	6 (1.9)	556 (13.3)	15 (3.3)	531 (8.5)	21 (3.5)	539 (8.2)	58 (4.5)	553 (4.6)
Slovenia	r 4 (1.9)	537 (23.2)	19 (4.0)	533 (6.0)	55 (5.0)	542 (5.5)	22 (3.8)	550 (6.2)
Spain	3 (0.8)	472 (17.7)	8 (2.4)	487 (7.6)	39 (4.3)	488 (3.8)	50 (4.3)	488 (3.1)
Sweden	16 (2.4)	529 (7.1)	15 (2.8)	512 (9.5)	26 (3.1)	518 (6.2)	44 (4.1)	520 (4.4)
Switzerland	14 (3.3)	540 (10.1)	6 (1.8)	545 (19.0)	37 (4.6)	549 (8.4)	42 (4.9)	548 (7.4)
Thailand	s 48 (6.6)	517 (8.9)	12 (2.6)	499 (9.3)	35 (6.2)	540 (10.9)	5 (3.4)	615 (17.7)
United States	25 (3.4)	484 (6.3)	14 (2.7)	488 (9.8)	25 (3.2)	501 (7.3)	36 (3.3)	513 (7.5)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

WHAT ARE TEACHERS' PERCEPTIONS ABOUT MATHEMATICS?

Figure 5.1 depicts the percentages of eighth-grade students whose mathematics teachers reported certain beliefs about mathematics and the way mathematics should be taught. Teachers in many countries indicated a fairly practical view of mathematics, seeing it essentially as a way of modeling the real world. However, there was variation across countries in the amount of agreement with this view of the nature of mathematics. In Thailand and Iran, nearly all students had teachers who agreed or strongly agreed that mathematics is primarily a formal way of representing the real world, while in several of the Central or Eastern European countries (Slovenia, the Russian Federation, the Czech Republic, and Hungary), about 40% or fewer of the students' mathematics teachers agreed with this view.

There also appeared to be nearly uniform agreement by teachers across countries about the inherent nature of mathematical abilities. In most countries, 80% or more of the students had teachers who agreed that some students have a natural talent for mathematics.

Regarding perceptions about how to teach mathematics, teachers' opinions varied across countries concerning whether or not more practice during class is an effective approach to help students having difficulty. At least 80% of the eighth-grade students in the Czech Republic, Cyprus, Greece, Iran, the Slovak Republic, Thailand, Kuwait, Portugal, and Romania had teachers who agreed or strongly agreed with this approach. Conversely, fewer than 20% of the students in the Russian Federation and Norway had teachers who agreed with this approach.

There was nearly complete agreement by teachers across countries, however, that more than one representation should be used in teaching a mathematics topic. In only Hungary and Thailand did fewer than 80% of the eighth-grade students have teachers that agreed with this approach. This instructional approach is particularly useful in helping students with different learning styles understand key ideas. Also, using data in different formats reinforces the idea of mathematics as a network of interconnected concepts and procedures.

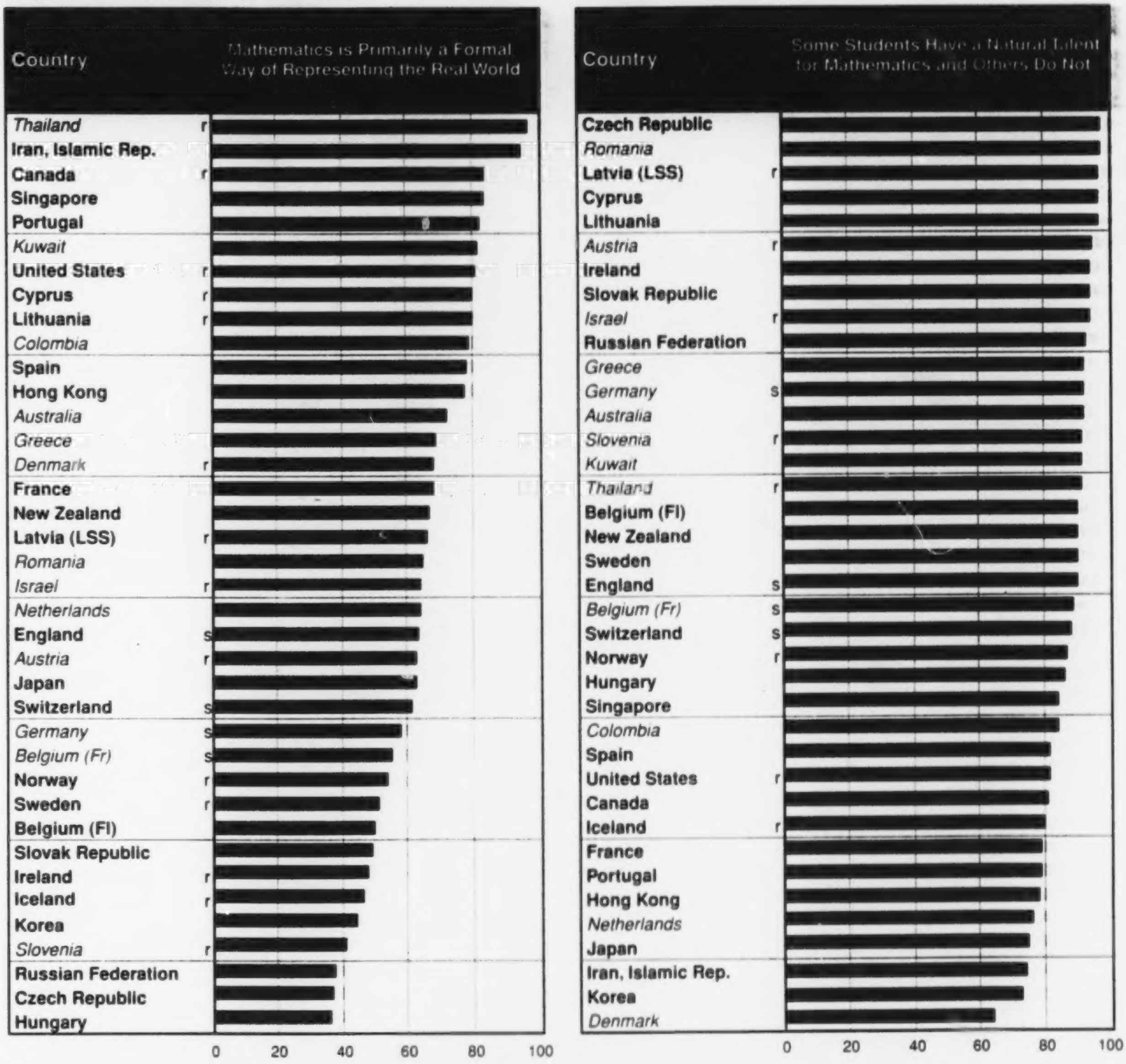
TIMSS also queried teachers about the cognitive demands of mathematics, asking them to rate the importance of various skills for success in the discipline. Figure 5.2 shows the percentages of students whose teachers rated each of four different skills as very important. Across the participating countries, the fewest students had teachers who felt the ability to remember formulas and procedures was very important. There was a range, however, with teachers of approximately 70% of the eighth-grade students in Kuwait and Ireland rating this ability as very important compared to those of fewer than 20% of the students in Slovenia, Sweden, Korea, Austria, Portugal, Israel, Denmark, the Czech Republic, and Switzerland.

Internationally, most mathematics teachers felt it was very important for students to be able to think creatively, to understand how mathematics is used in the real world, and to be able to provide reasons to support their solutions. However, there was some variation across countries. Fewer than 40% of the eighth-grade students in

Israel, Austria, Belgium (Flemish), Switzerland, Ireland, England, and France had teachers who felt it was very important to think creatively, and fewer than 40% in Latvia (LSS), Korea, Thailand, Belgium (Flemish), Hong Kong, France, Israel, the Netherlands, Switzerland, and Ireland had teachers who felt it was very important to understand how mathematics is used in the real world. With the current calls from business and industry for helping students improve their ability to apply mathematics and solve practical problems in job-related situations, it might be rather surprising that teachers in these countries do not place more importance on these latter two aspects of mathematics. In all countries except the Czech Republic, Switzerland, the Netherlands, and Austria, the majority of students had teachers who felt it was very important to be able to provide reasons to support mathematical solutions.

Figure 5.1

Percent of Students Whose Mathematics Teachers Agree or Strongly Agree with Statements About the Nature of Mathematics and Mathematics Teaching Upper Grade (Eighth Grade*)



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*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

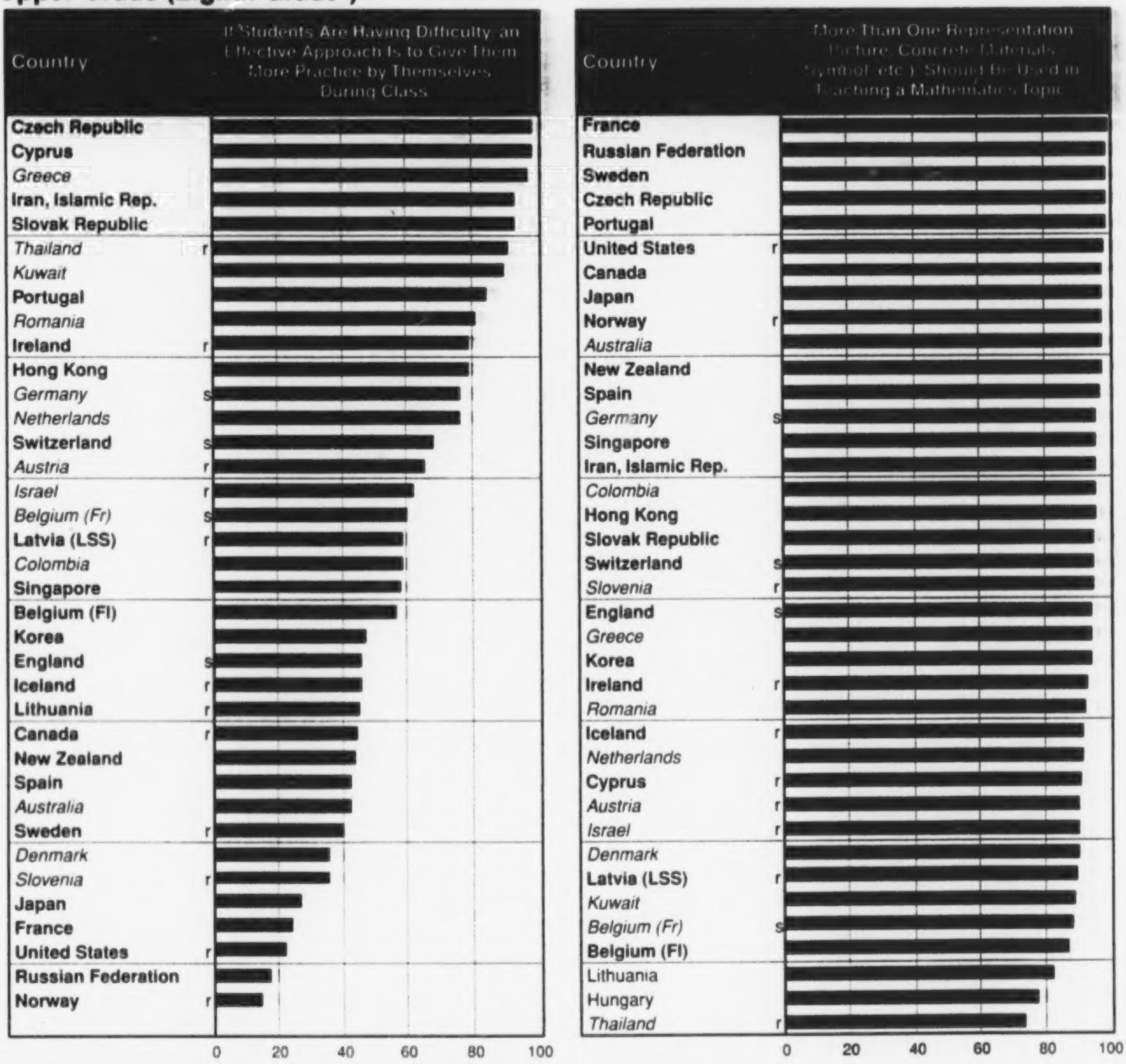
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Scotland did not ask these questions.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 5.1 (Continued)

Percent of Students Whose Mathematics Teachers Agree or Strongly Agree with Statements About the Nature of Mathematics and Mathematics Teaching Upper Grade (Eighth Grade*)



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*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

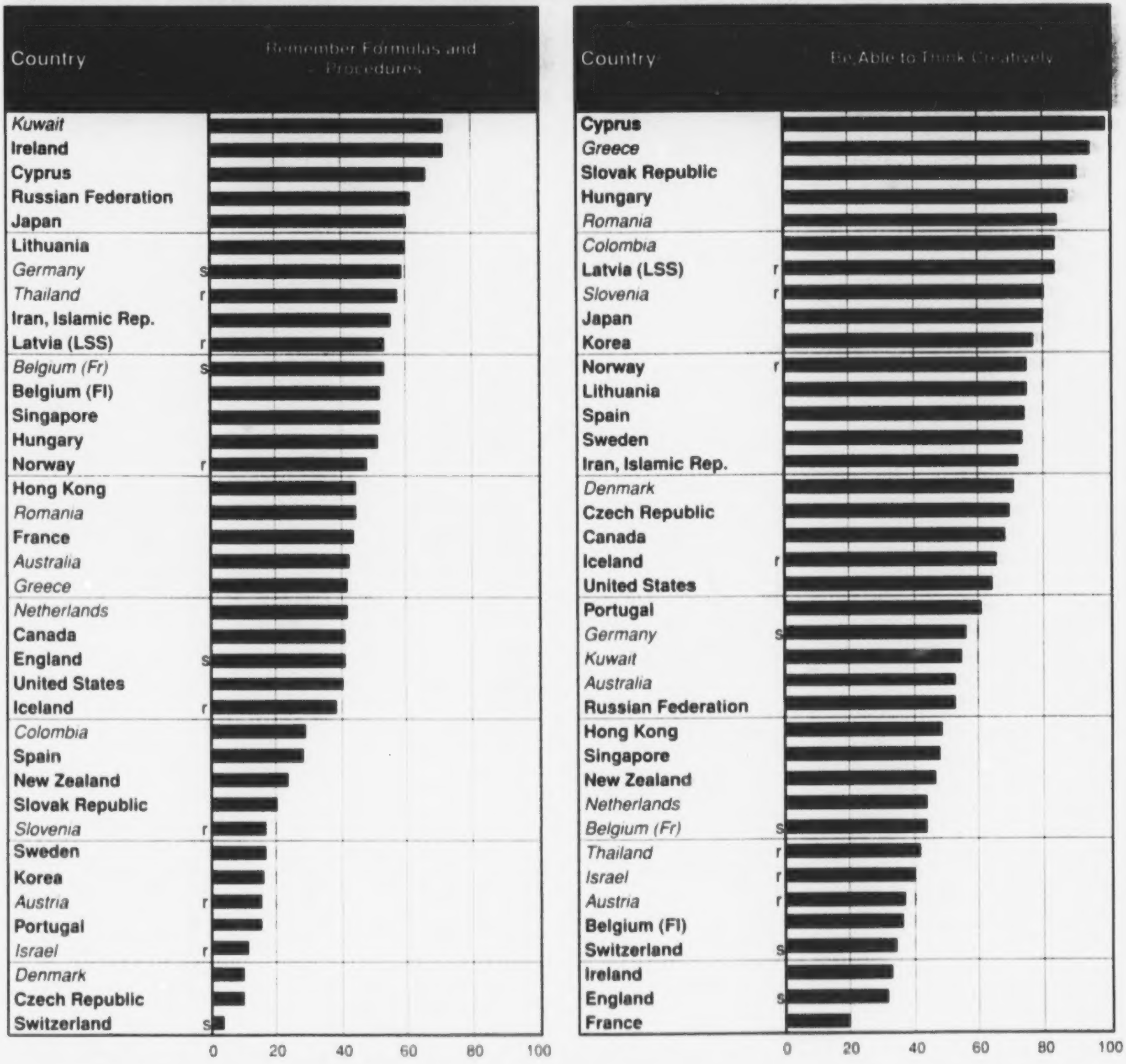
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Scotland did not ask these questions. Hungary did not ask teachers their opinions about the effectiveness of more individual practice.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 5.2

Percent of Students Whose Mathematics Teachers Think Particular Abilities Are Very Important for Students' Success in Mathematics in School - Upper Grade (Eighth Grade*)



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*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

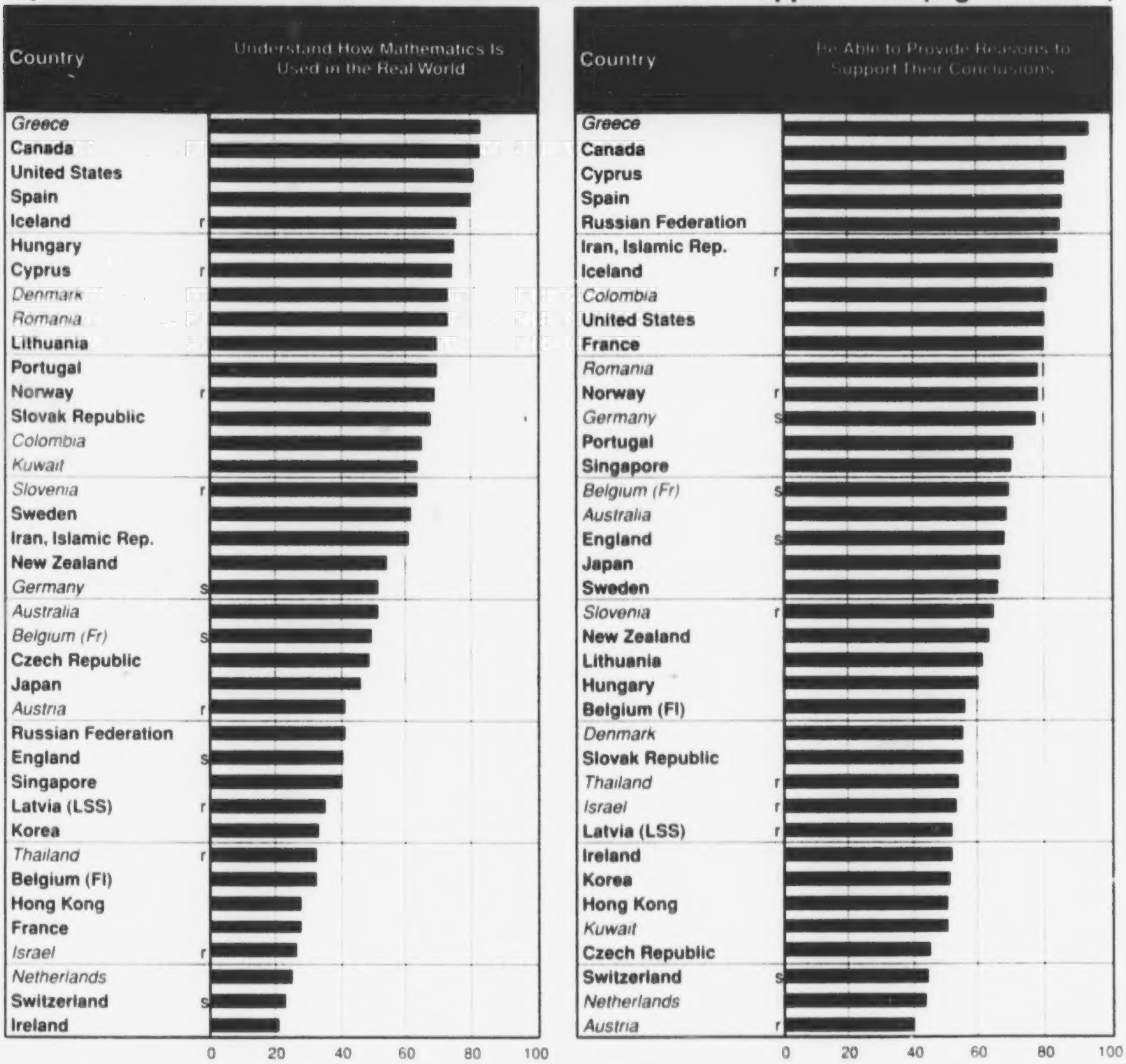
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Scotland did not ask these questions.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 5.2 (Continued)

Percent of Students Whose Mathematics Teachers Think Particular Abilities Are Very Important for Students' Success in Mathematics in School - Upper Grade (Eighth Grade*)



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*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

Scotland did not ask these questions.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

HOW DO MATHEMATICS TEACHERS SPEND THEIR SCHOOL-RELATED TIME?

The data in Table 5.4 reveal that in a number of countries, eighth-grade mathematics teachers are specialists. In Belgium (Flemish), Belgium (French), Cyprus, England, France, Kuwait, Lithuania, the Netherlands, New Zealand, Portugal, the Russian Federation, Scotland, and Slovenia, the majority of eighth-grade students had teachers who spent at least 75% of their formally scheduled school time teaching mathematics.

For most participating countries, there was little difference in students' achievement according to whether they were taught by specialists. However, in some countries, such as Austria, England, France, Germany, Ireland, and Switzerland those students with specialists for teachers had higher average mathematics achievement. In Switzerland, this is at least partially because specialists teach the students in the higher tracks and generalists the students in lower tracks, and a similar situation may exist in the other countries displaying this relationship between achievement and degree of teaching specialization. Generally, it is important to keep in mind the complexity of the relationships between instruction and achievement. In tracked systems, many characteristics of instruction can be related to the track.

As shown in Table 5.5, teachers in most countries reported that mathematics classes typically meet for at least 2 hours per week, but less than 3.5 hours. However, from 3.5 up to nearly 5 hours of weekly class time was reported for 50% or more of the eighth-grade students in Belgium (Flemish), Belgium (French), Canada, Colombia, the Czech Republic, France, Hong Kong, Kuwait, Latvia (LSS), New Zealand, the Russian Federation, Scotland, the Slovak Republic, Spain, Switzerland, and the United States. The data reveal no clear pattern between the number of in-class instructional hours and mathematics achievement either across or between countries. Common sense and research both support the idea that increased time on task can yield commensurate increases in achievement, yet this time also can be spent outside of school on homework or in special tutoring. The ability to use straightforward analyses such as these to disentangle complicated relationships also is made difficult by the practice of providing additional in-school instruction for lower-performing students.

In addition to their formally scheduled duties, teachers were asked about the number of hours per week spent on selected school-related activities outside the regular school day. Table 5.6 presents the results. For example, on average, eighth-grade students in Australia had mathematics teachers who spent 2.3 hours per week preparing or grading tests, and another 1.8 hours per week reading and grading papers. Their teachers spent 2.6 hours per week on lesson planning and 1.7 hours combined on meetings with students and parents. They spent 0.9 hours on professional reading and development and 3 hours on record keeping and administrative tasks combined. Across countries, teachers reported that grading tests, grading student work, and lesson planning were the most time consuming activities, averaging as much as 10 hours per week in Singapore. In general, teachers also reported several hours per week spent on keeping students' records and other administrative tasks.

Opportunities to meet with colleagues to plan curriculum or teaching approaches enable teachers to expand their views of mathematics, their resources for teaching, and their repertoire of teaching and learning skills. Table 5.7 contains teachers' reports on how often they meet with other teachers in their subject area to discuss and plan curriculum or teaching approaches. Teachers of the majority of the students reported weekly or even daily planning meetings in Belgium (French), Colombia, Cyprus, the Czech Republic, England, Hungary, Israel, Kuwait, Latvia (LSS), Lithuania, Norway, Scotland, the Slovak Republic, Slovenia, and Sweden. In the remaining countries, however, most students had mathematics teachers who reported only limited opportunities to plan curriculum or teaching approaches with other teachers (monthly or even yearly meetings).

Table 5.4

Teachers' Reports on the Proportion of Their Formally Scheduled School Time Spent Teaching Mathematics[1] - Upper Grade (Eighth Grade*)

Country	Less Than 50 Percent		50-74 Percent		75-100 Percent	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	37 (3.1)	527 (5.4)	25 (3.2)	526 (8.2)	38 (3.6)	541 (8.8)
Austria	r 51 (3.3)	537 (6.3)	30 (3.1)	548 (7.8)	19 (3.2)	575 (13.8)
Belgium (Fl)	12 (3.0)	573 (16.9)	29 (4.4)	543 (14.0)	60 (4.4)	579 (9.2)
Belgium (Fr)	s 8 (3.0)	554 (9.6)	12 (4.0)	535 (14.1)	80 (4.9)	546 (4.5)
Canada	59 (3.3)	520 (3.2)	26 (3.2)	543 (7.7)	15 (2.2)	532 (7.2)
Colombia	34 (3.5)	381 (3.8)	36 (4.2)	402 (4.2)	30 (4.1)	384 (5.5)
Cyprus	r 3 (2.0)	472 (16.2)	6 (2.0)	472 (8.4)	91 (2.8)	471 (2.5)
Czech Republic	58 (4.7)	565 (7.0)	30 (4.5)	564 (9.7)	12 (3.3)	561 (7.8)
Denmark	65 (4.6)	505 (3.2)	27 (4.2)	499 (4.2)	8 (2.8)	519 (10.4)
England	s 10 (2.0)	495 (26.0)	21 (2.9)	499 (10.7)	69 (2.8)	524 (4.6)
France	6 (1.6)	496 (15.2)	9 (2.6)	529 (17.6)	85 (2.9)	542 (3.4)
Germany	s 49 (5.5)	499 (9.5)	35 (5.2)	518 (9.9)	17 (3.3)	552 (7.5)
Greece	- -	- -	- -	- -	- -	- -
Hong Kong	42 (6.1)	603 (10.0)	21 (5.1)	570 (15.1)	36 (4.8)	580 (11.7)
Hungary	- -	- -	- -	- -	- -	- -
Iceland	r 56 (6.6)	486 (4.9)	26 (8.2)	494 (8.7)	18 (6.5)	492 (18.8)
Iran, Islamic Rep.	23 (5.7)	430 (5.6)	32 (5.2)	431 (3.6)	45 (5.0)	430 (2.6)
Ireland	37 (4.3)	502 (9.5)	24 (3.6)	528 (10.7)	39 (4.7)	547 (8.9)
Israel	r 25 (6.7)	520 (15.9)	28 (7.8)	514 (14.0)	47 (8.4)	531 (9.8)
Japan	24 (3.3)	606 (6.0)	40 (4.0)	606 (4.5)	37 (3.5)	603 (4.3)
Korea	45 (4.5)	607 (4.1)	46 (4.5)	610 (4.1)	10 (2.6)	623 (8.3)
Kuwait	r 17 (5.8)	395 (5.5)	28 (6.9)	386 (3.9)	55 (8.0)	395 (4.3)
Latvia (LSS)	r 23 (4.2)	484 (6.5)	35 (4.5)	485 (6.4)	43 (4.9)	498 (4.5)
Lithuania	8 (1.9)	498 (7.3)	8 (2.1)	451 (9.4)	84 (2.9)	478 (4.4)
Netherlands	4 (2.0)	526 (44.0)	18 (4.5)	494 (25.9)	79 (4.9)	555 (6.8)
New Zealand	28 (3.5)	493 (8.2)	18 (3.4)	526 (12.6)	54 (4.0)	511 (6.1)
Norway	49 (4.4)	504 (3.5)	39 (4.5)	503 (3.6)	12 (2.5)	506 (3.9)
Portugal	5 (2.0)	452 (7.0)	15 (3.1)	447 (6.9)	80 (3.6)	456 (2.9)
Romania	73 (4.2)	485 (5.2)	20 (3.7)	480 (9.2)	6 (2.2)	437 (8.2)
Russian Federation	0 (0.2)	~ ~	2 (1.2)	~ ~	98 (1.2)	536 (5.4)
Scotland	r 2 (1.3)	~ ~	6 (2.4)	479 (36.5)	92 (2.7)	495 (6.4)
Singapore	22 (3.4)	626 (9.6)	53 (5.1)	658 (7.2)	25 (4.5)	630 (7.5)
Slovak Republic	61 (4.0)	547 (3.8)	26 (3.6)	544 (7.3)	13 (3.3)	553 (10.7)
Slovenia	r 14 (3.6)	550 (8.6)	22 (3.8)	531 (6.4)	63 (4.4)	543 (4.6)
Spain	69 (4.1)	487 (2.6)	26 (4.0)	486 (5.0)	5 (2.0)	499 (17.3)
Sweden	89 (2.3)	519 (3.2)	10 (2.1)	524 (10.2)	1 (0.8)	~ ~
Switzerland	52 (4.0)	532 (5.2)	30 (3.9)	552 (9.7)	18 (2.2)	579 (7.3)
Thailand	r 26 (5.6)	521 (14.6)	30 (5.0)	525 (11.8)	44 (5.9)	533 (9.7)
United States	38 (3.7)	494 (5.4)	31 (4.0)	506 (8.9)	31 (3.7)	501 (6.8)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

[1] Formally scheduled school time included time scheduled for teaching all subjects, as well as student supervision, student counseling/appraisal, administrative duties, individual curriculum planning, cooperative curriculum planning, and other non-student contact time.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Table 5.5

Teachers' Reports on Average Number of Hours Mathematics Is Taught Weekly to Their Mathematics Classes - Upper Grade (Eighth Grade*)

Country	Less Than 2 Hours		2 Hours to < 3.5		3.5 Hours to < 5		5 Hours or More	
	Percent of Students	**Mean Achievement**	**Percent of Students**	**Mean Achievement**	**Percent of Students**	**Mean Achievement**	**Percent of Students**	**Mean Achievement**
Australia	r 5 (1.7)	528 (19.5)	50 (3.7)	518 (6.2)	44 (3.7)	552 (7.6)	1 (0.7)	~ ~
Austria	r 0 (0.0)	~ ~	99 (0.1)	549 (4.1)	1 (0.1)	~ ~	0 (0.0)	~ ~
Belgium (Fl)	s 0 (0.0)	~ ~	50 (4.4)	572 (5.6)	50 (4.4)	603 (5.4)	0 (0.0)	~ ~
Belgium (Fr)	s 0 (0.0)	~ ~	3 (1.8)	486 (12.9)	83 (4.2)	544 (4.7)	14 (3.8)	564 (10.0)
Canada	3 (1.2)	528 (11.8)	31 (3.8)	521 (5.0)	50 (3.6)	537 (4.3)	17 (3.1)	520 (10.2)
Colombia	r 4 (2.0)	389 (8.2)	25 (5.5)	367 (8.8)	58 (5.4)	397 (3.9)	13 (3.3)	390 (8.2)
Cyprus	x x	x x	x x	x x	x x	x x	x x	x x
Czech Republic	1 (0.9)	~ ~	6 (2.0)	587 (17.2)	90 (2.7)	561 (5.1)	3 (1.6)	535 (10.2)
Denmark	- -	- -	- -	- -	- -	- -	- -	- -
England	- -	- -	- -	- -	- -	- -	- -	- -
France	r 2 (1.4)	~ ~	10 (3.2)	532 (13.4)	87 (3.3)	539 (3.9)	2 (1.3)	~ ~
Germany	s 2 (1.5)	~ ~	85 (3.1)	523 (5.3)	12 (2.9)	463 (13.3)	1 (0.9)	~ ~
Greece	4 (1.7)	459 (10.8)	88 (2.8)	486 (3.5)	3 (1.6)	459 (12.3)	4 (1.6)	480 (8.9)
Hong Kong	5 (2.4)	612 (47.4)	26 (5.2)	590 (19.5)	63 (5.8)	590 (7.6)	6 (2.9)	567 (30.1)
Hungary	0 (0.0)	~ ~	75 (3.6)	538 (3.9)	23 (3.6)	536 (7.0)	1 (1.0)	~ ~
Iceland	r 0 (0.0)	~ ~	90 (2.9)	492 (5.3)	8 (2.9)	467 (3.5)	1 (0.2)	~ ~
Iran, Islamic Rep.	- -	- -	- -	- -	- -	- -	- -	- -
Ireland	r 1 (0.7)	~ ~	86 (3.7)	524 (6.4)	12 (3.4)	555 (15.2)	1 (1.1)	~ ~
Israel	r 6 (4.1)	523 (13.7)	41 (8.0)	520 (12.7)	47 (8.1)	514 (9.2)	6 (3.7)	579 (22.6)
Japan	4 (1.8)	607 (24.3)	91 (2.3)	602 (2.7)	4 (1.4)	649 (18.5)	0 (0.5)	~ ~
Korea	1 (0.7)	~ ~	90 (3.0)	610 (2.8)	5 (1.8)	608 (13.8)	5 (2.3)	604 (19.5)
Kuwait	2 (1.6)	~ ~	21 (6.5)	396 (6.8)	76 (6.6)	391 (2.3)	1 (1.0)	~ ~
Latvia (LSS)	1 (0.5)	~ ~	30 (4.8)	491 (5.8)	62 (5.3)	492 (4.3)	8 (2.6)	489 (15.0)
Lithuania	1 (0.8)	~ ~	61 (4.1)	482 (5.0)	29 (3.9)	481 (7.5)	9 (2.3)	448 (13.8)
Netherlands	3 (1.9)	529 (54.2)	97 (1.9)	542 (8.1)	0 (0.0)	~ ~	0 (0.0)	~ ~
New Zealand	5 (1.8)	484 (11.6)	42 (4.3)	514 (7.1)	50 (4.3)	507 (6.4)	3 (1.5)	503 (27.3)
Norway	r 7 (2.6)	502 (5.0)	80 (3.9)	508 (3.1)	8 (2.8)	502 (7.7)	5 (2.1)	513 (7.7)
Portugal	1 (0.8)	~ ~	89 (2.9)	455 (2.7)	10 (2.8)	452 (7.8)	0 (0.0)	~ ~
Romania	8 (2.6)	497 (17.6)	80 (3.4)	481 (5.0)	9 (2.5)	482 (12.4)	2 (0.6)	~ ~
Russian Federation	0 (0.0)	~ ~	17 (3.6)	519 (8.6)	70 (5.6)	533 (5.1)	14 (4.8)	567 (18.0)
Scotland	5 (2.0)	473 (14.7)	35 (4.4)	500 (11.6)	60 (4.6)	494 (7.1)	0 (0.0)	~ ~
Singapore	0 (0.0)	~ ~	52 (4.7)	654 (6.9)	48 (4.7)	633 (7.6)	0 (0.0)	~ ~
Slovak Republic	0 (0.0)	~ ~	2 (1.3)	~ ~	86 (3.0)	544 (3.2)	11 (2.9)	561 (11.0)
Slovenia	r 0 (0.0)	~ ~	87 (3.4)	542 (4.0)	12 (3.3)	525 (9.5)	1 (0.8)	~ ~
Spain	r 2 (1.1)	~ ~	28 (4.0)	480 (5.5)	62 (4.7)	490 (3.6)	8 (2.6)	494 (9.2)
Sweden	r 3 (1.2)	506 (24.2)	97 (1.3)	520 (3.2)	0 (0.4)	~ ~	0 (0.3)	~ ~
Switzerland	s 2 (1.4)	~ ~	14 (3.4)	520 (17.8)	71 (3.5)	557 (6.5)	13 (3.0)	566 (12.4)
Thailand	x x	x x	x x	x x	x x	x x	x x	x x
United States	s 8 (1.4)	492 (26.2)	24 (3.4)	501 (9.9)	58 (4.4)	507 (5.4)	11 (2.8)	498 (10.0)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.6

Average Number of Hours[1] Students' Teachers Spend on Various School-Related Activities Outside the Formal School Day During the School Week Mathematics - Upper Grade (Eighth Grade*)

Country	Preparing or Grading Tests	Reading and Grading Student Work	Planning Lessons by Self	Meeting with Students Outside Classroom Time	Meeting with Parents	Professional Reading and Development	Keeping Students' Records	Administrative Tasks
Australia	2.3 (0.1)	1.8 (0.1)	2.6 (0.1)	1.3 (0.1)	0.4 (0.0)	0.9 (0.1)	1.0 (0.1)	2.0 (0.1)
Austria	r 2.3 (0.1)	r 2.5 (0.1)	r 3.6 (0.1)	r 0.4 (0.1)	r 0.6 (0.0)	r 1.5 (0.1)	r 0.9 (0.1)	r 1.1 (0.1)
Belgium (Fl)	3.8 (0.1)	2.3 (0.1)	2.9 (0.2)	0.8 (0.1)	0.6 (0.1)	0.6 (0.1)	0.5 (0.0)	1.2 (0.1)
Belgium (Fr)	s 3.4 (0.2)	s 1.6 (0.1)	s 2.8 (0.2)	s 0.7 (0.1)	s 0.5 (0.1)	s 0.9 (0.1)	s 0.7 (0.1)	s 1.2 (0.1)
Canada	2.3 (0.1)	2.4 (0.1)	2.6 (0.1)	1.4 (0.1)	0.5 (0.0)	0.8 (0.1)	1.1 (0.0)	1.7 (0.1)
Colombia	2.8 (0.1)	r 1.8 (0.1)	3.1 (0.1)	1.2 (0.1)	0.8 (0.1)	1.9 (0.2)	r 0.8 (0.1)	1.1 (0.1)
Cyprus	3.4 (0.1)	r 1.3 (0.2)	r 3.2 (0.2)	r 0.3 (0.1)	r 1.1 (0.1)	r 0.9 (0.1)	r 0.5 (0.0)	r 1.0 (0.1)
Czech Republic	3.4 (0.1)	1.6 (0.1)	4.0 (0.1)	1.2 (0.1)	0.5 (0.0)	0.8 (0.1)	0.9 (0.1)	1.3 (0.1)
Denmark	- -	- -	- -	- -	- -	- -	- -	- -
England	s 2.1 (0.1)	s 3.7 (0.1)	s 2.6 (0.1)	s 1.4 (0.1)	s 0.6 (0.0)	s 0.9 (0.1)	s 0.7 (0.1)	s 2.2 (0.1)
France	4.0 (0.1)	r 1.1 (0.1)	3.4 (0.2)	0.7 (0.1)	0.6 (0.0)	r 1.2 (0.1)	0.7 (0.0)	1.0 (0.1)
Germany	s 3.1 (0.1)	s 2.2 (0.2)	s 4.2 (0.1)	s 0.8 (0.1)	s 0.8 (0.1)	s 1.8 (0.2)	s 1.1 (0.1)	s 1.7 (0.1)
Greece	2.4 (0.1)	1.0 (0.1)	2.0 (0.2)	0.4 (0.1)	0.9 (0.1)	2.1 (0.1)	r 0.5 (0.1)	1.2 (0.1)
Hong Kong	2.4 (0.2)	3.1 (0.2)	2.2 (0.2)	1.7 (0.2)	0.4 (0.1)	1.0 (0.2)	0.7 (0.1)	1.2 (0.1)
Hungary	3.0 (0.1)	2.5 (0.1)	4.0 (0.1)	1.9 (0.1)	0.8 (0.1)	1.8 (0.1)	0.8 (0.1)	2.3 (0.1)
Iceland	r 2.0 (0.2)	r 2.3 (0.3)	r 3.0 (0.2)	r 0.9 (0.1)	r 0.8 (0.1)	r 0.9 (0.1)	r 1.3 (0.2)	r 2.2 (0.2)
Iran, Islamic Rep.	2.6 (0.2)	1.9 (0.2)	2.1 (0.1)	1.0 (0.1)	0.8 (0.1)	0.5 (0.1)	2.0 (0.1)	1.1 (0.2)
Ireland	2.3 (0.1)	1.6 (0.1)	2.3 (0.1)	0.8 (0.1)	0.3 (0.0)	0.5 (0.1)	0.7 (0.0)	1.3 (0.1)
Israel	r 3.6 (0.2)	r 1.7 (0.2)	r 2.9 (0.3)	r 1.5 (0.2)	r 0.9 (0.1)	r 2.8 (0.3)	r 1.1 (0.2)	r 1.9 (0.2)
Japan	2.0 (0.1)	1.8 (0.1)	2.9 (0.1)	1.8 (0.1)	0.4 (0.0)	1.8 (0.1)	1.4 (0.1)	2.6 (0.2)
Korea	1.7 (0.1)	1.5 (0.1)	2.1 (0.1)	1.6 (0.1)	0.4 (0.0)	1.2 (0.1)	0.9 (0.1)	2.0 (0.1)
Kuwait	2.4 (0.2)	2.1 (0.3)	2.7 (0.2)	0.4 (0.1)	0.6 (0.1)	1.0 (0.2)	0.9 (0.2)	0.9 (0.2)
Latvia (LSS)	3.0 (0.2)	r 2.8 (0.2)	3.3 (0.1)	r 1.8 (0.1)	r 0.7 (0.1)	r 1.1 (0.1)	r 0.4 (0.1)	r 1.0 (0.1)
Lithuania	1.5 (0.1)	2.7 (0.2)	3.1 (0.1)	1.6 (0.1)	0.8 (0.1)	1.9 (0.1)	0.8 (0.1)	r 0.6 (0.1)
Netherlands	3.7 (0.2)	0.7 (0.1)	2.5 (0.2)	1.0 (0.1)	0.6 (0.0)	1.1 (0.1)	0.4 (0.0)	1.1 (0.1)
New Zealand	2.3 (0.1)	1.7 (0.1)	3.0 (0.1)	1.3 (0.1)	0.4 (0.0)	1.0 (0.1)	0.8 (0.0)	2.3 (0.1)
Norway	2.4 (0.1)	1.6 (0.1)	3.6 (0.1)	0.8 (0.1)	0.7 (0.0)	0.6 (0.1)	0.9 (0.1)	1.8 (0.1)
Portugal	2.8 (0.1)	1.9 (0.1)	3.3 (0.1)	0.9 (0.1)	0.5 (0.1)	1.0 (0.1)	0.9 (0.1)	1.2 (0.1)
Romania	2.8 (0.1)	2.4 (0.1)	3.6 (0.1)	2.0 (0.1)	1.0 (0.1)	1.3 (0.1)	1.6 (0.1)	2.2 (0.1)
Russian Federation	2.6 (0.1)	3.4 (0.1)	3.5 (0.2)	2.4 (0.1)	1.2 (0.1)	2.3 (0.1)	1.0 (0.1)	2.1 (0.1)
Scotland	1.5 (0.1)	r 2.0 (0.1)	1.8 (0.1)	1.0 (0.1)	0.5 (0.1)	0.8 (0.1)	1.0 (0.1)	1.5 (0.1)
Singapore	3.4 (0.1)	4.1 (0.1)	2.7 (0.1)	1.6 (0.1)	0.4 (0.0)	1.1 (0.1)	1.1 (0.1)	2.0 (0.1)
Slovak Republic	2.9 (0.1)	1.9 (0.1)	3.6 (0.1)	1.3 (0.1)	0.7 (0.0)	0.9 (0.1)	1.1 (0.1)	1.1 (0.1)
Slovenia	r 2.6 (0.1)	r 1.0 (0.1)	r 3.7 (0.1)	r 1.2 (0.1)	r 1.2 (0.1)	r 1.7 (0.1)	r 0.6 (0.0)	r 1.8 (0.1)
Spain	2.1 (0.1)	1.4 (0.1)	1.8 (0.1)	0.9 (0.1)	1.1 (0.0)	1.6 (0.1)	0.8 (0.0)	1.7 (0.1)
Sweden	2.2 (0.1)	1.6 (0.1)	4.0 (0.1)	0.7 (0.0)	0.8 (0.0)	1.3 (0.1)	0.9 (0.0)	2.3 (0.1)
Switzerland	3.0 (0.1)	r 2.0 (0.1)	r 3.9 (0.1)	r 0.9 (0.1)	r 0.8 (0.1)	r 1.8 (0.1)	r 0.7 (0.0)	r 2.2 (0.1)
Thailand	s 2.6 (0.2)	s 1.9 (0.2)	r 1.8 (0.2)	s 1.5 (0.2)	s 0.5 (0.1)	s 1.3 (0.2)	s 1.1 (0.1)	s 1.5 (0.2)
United States	2.7 (0.1)	r 2.7 (0.2)	2.4 (0.1)	2.0 (0.1)	0.7 (0.0)	0.9 (0.1)	1.6 (0.1)	2.0 (0.1)

[1] Average hours based on: No time=0, Less Than 1 Hour=.5, 1-2 Hours=1.5; 3-4 Hours=3.5; More Than 4 Hours=5.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Table 5.7

Teachers' Reports on How Often They Meet with Other Teachers in Their Subject Area to Discuss and Plan Curriculum or Teaching Approaches Mathematics - Upper Grade (Eighth Grade*)

Country	Percent of Students Taught by Teachers Meeting Never or Once Twice a Year	Meeting Monthly or Every Other Month	Meeting Once, Twice, or Three Times a Week	Meeting Almost Every Day
Australia	12 (2.2)	52 (3.3)	24 (2.8)	12 (2.4)
Austria	r 17 (2.9)	37 (4.0)	36 (3.7)	9 (3.0)
Belgium (Fl)	52 (4.8)	29 (4.1)	15 (3.3)	4 (1.7)
Belgium (Fr)	s 19 (4.0)	29 (4.9)	41 (5.4)	11 (3.6)
Canada	29 (3.0)	33 (3.2)	30 (3.7)	8 (2.5)
Colombia	17 (3.6)	32 (4.3)	48 (4.6)	4 (1.7)
Cyprus	3 (1.8)	4 (1.6)	77 (3.8)	17 (3.0)
Czech Republic	12 (2.7)	30 (4.8)	37 (5.3)	21 (3.9)
Denmark	- -	- -	- -	- -
England	s 7 (1.7)	33 (3.3)	52 (3.8)	9 (1.4)
France	35 (5.2)	32 (4.9)	30 (4.5)	3 (1.9)
Germany	s 42 (5.8)	33 (4.8)	15 (3.9)	10 (3.1)
Greece	41 (4.1)	28 (4.9)	22 (3.9)	9 (2.5)
Hong Kong	30 (5.2)	53 (5.8)	16 (4.1)	1 (1.2)
Hungary	2 (1.3)	10 (2.7)	41 (4.4)	46 (4.2)
Iceland	r 23 (4.3)	31 (6.0)	41 (7.2)	4 (3.7)
Iran, Islamic Rep.	21 (5.3)	38 (5.3)	35 (4.3)	6 (2.3)
Ireland	62 (4.4)	24 (4.0)	12 (3.1)	2 (1.2)
Israel	r 5 (3.5)	20 (6.8)	53 (8.0)	21 (5.0)
Japan	23 (3.6)	28 (3.8)	46 (4.3)	3 (1.3)
Korea	23 (3.6)	37 (4.1)	37 (4.4)	3 (1.8)
Kuwait	2 (1.6)	2 (2.2)	67 (6.2)	29 (5.7)
Latvia (LSS)	r 19 (3.7)	31 (3.8)	28 (4.1)	22 (3.8)
Lithuania	14 (2.6)	29 (4.3)	26 (3.5)	31 (3.8)
Netherlands	12 (3.6)	65 (5.6)	21 (4.2)	1 (1.4)
New Zealand	10 (2.5)	43 (4.0)	45 (4.0)	2 (1.0)
Norway	6 (2.1)	17 (3.4)	71 (3.8)	6 (2.0)
Portugal	7 (1.9)	72 (3.9)	18 (3.2)	3 (1.7)
Romania	7 (2.1)	45 (4.0)	24 (3.4)	24 (3.4)
Russian Federation	8 (3.0)	55 (4.3)	25 (3.8)	12 (3.3)
Scotland	5 (2.2)	20 (3.9)	69 (4.2)	6 (2.3)
Singapore	10 (3.1)	68 (4.5)	16 (3.4)	6 (2.4)
Slovak Republic	3 (1.4)	23 (3.6)	30 (4.1)	44 (4.3)
Slovenia	r 2 (1.4)	26 (4.5)	26 (4.2)	46 (4.4)
Spain	16 (3.0)	43 (4.4)	39 (4.6)	2 (1.2)
Sweden	9 (2.3)	17 (2.7)	49 (3.9)	24 (3.2)
Switzerland	r 38 (3.8)	33 (3.8)	26 (3.5)	3 (1.4)
Thailand	r 53 (6.2)	31 (5.7)	12 (4.1)	4 (2.6)
United States	29 (3.7)	37 (3.9)	26 (3.7)	8 (2.4)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

HOW ARE MATHEMATICS CLASSES ORGANIZED?

Table 5.8 presents teachers' reports about the size of eighth-grade mathematics classes for the TIMSS countries. The data reveal rather large variations from country to country. According to teachers, mathematics classes were relatively small in a number of countries. For example, 90% or more of the students were in mathematics classes of 30 or fewer students in Belgium (Flemish), Belgium (French), the Czech Republic, Denmark, France, Germany, Hungary, Iceland, Latvia (LSS), Lithuania, the Netherlands, Norway, Portugal, the Russian Federation, Scotland, Slovenia, Sweden, and Switzerland. At the other end of the spectrum, 93% of the students in Korea and 48% in Colombia were in mathematics classes with more than 40 students. In Hong Kong, Japan, and Singapore, 90% of the students were in classes with more than 30 students. Extensive research about class size in relation to achievement indicates that the existence of such a relationship is dependent on the situation. Dramatic reductions in class size can be related to gains in achievement, but the chief effects of smaller classes often are in relation to teacher attitudes and instructional behaviors. The TIMSS data support the complexity of this issue. Across countries, the four highest-performing countries at the eighth grade – Singapore, Korea, Japan, and Hong Kong – are among those with the largest mathematics classes. Within countries, several show little or no relationship between achievement and class size, often because students are mostly all in classes of similar size. Within other countries, there appears to be a curvilinear relationship, or those students with higher achievement appear to be in larger classes. In some countries, larger classes may represent the more usual situation for mathematics teaching, with smaller classes used primarily for students needing remediation or for those students in the less-advanced tracks.

Teachers can adopt a variety of organizational and interactive approaches in mathematics class. Whole-class instruction can be very efficient, because it requires less time on management functions and provides more time for developing mathematics concepts. Teachers can make presentations, conduct discussions, or demonstrate procedures and applications to all students simultaneously. Both whole-class and independent work have been standard features of mathematics classrooms. Students also can benefit from the type of cooperative learning that occurs with effective use of small-group work. Because they can help each other, students in groups can often handle challenging situations beyond their individual capabilities. Further, the positive affective impact of working together mirrors the use of mathematics in the workplace.

Table 5.8

Teachers' Reports on Average Size of Mathematics Class Upper Grade (Eighth Grade*)

Country	1 - 20 Students		21 - 30 Students		31 - 40 Students		41 or More Students	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	r 13 (2.4)	497 (14.6)	71 (3.3)	528 (5.4)	16 (2.6)	583 (9.7)	1 (0.5)	~ ~
Austria	x x	x x	x x	x x	x x	x x	x x	x x
Belgium (Fl)	49 (3.6)	552 (8.2)	51 (3.6)	596 (4.4)	0 (0.0)	~ ~	0 (0.0)	~ ~
Belgium (Fr)	s 43 (5.3)	535 (6.2)	57 (5.3)	551 (6.1)	0 (0.0)	~ ~	0 (0.0)	~ ~
Canada	r 11 (2.1)	524 (10.3)	65 (4.0)	527 (3.4)	23 (3.6)	534 (11.7)	1 (0.5)	~ ~
Colombia	r 16 (4.2)	400 (24.3)	6 (2.2)	361 (4.1)	29 (4.0)	394 (6.5)	48 (4.6)	384 (3.9)
Cyprus	r 1 (0.0)	~ ~	37 (3.9)	467 (4.3)	62 (3.9)	474 (3.2)	0 (0.0)	~ ~
Czech Republic	13 (3.3)	534 (6.2)	77 (5.3)	564 (6.2)	11 (4.5)	591 (13.7)	0 (0.0)	~ ~
Denmark	r 49 (4.8)	504 (3.8)	51 (4.8)	506 (3.7)	0 (0.0)	~ ~	0 (0.0)	~ ~
England	s 18 (3.1)	482 (12.2)	62 (3.7)	511 (5.9)	20 (3.4)	554 (7.9)	0 (0.0)	~ ~
France	11 (2.6)	512 (8.8)	86 (2.9)	543 (3.9)	3 (1.8)	519 (8.7)	0 (0.0)	~ ~
Germany	s 25 (4.4)	493 (15.6)	72 (4.5)	522 (5.6)	3 (1.8)	558 (40.8)	0 (0.0)	~ ~
Greece	9 (2.3)	462 (9.7)	64 (4.4)	489 (3.3)	27 (3.9)	481 (7.2)	0 (0.0)	~ ~
Hong Kong	3 (1.9)	501 (63.7)	4 (2.2)	605 (35.3)	56 (5.7)	584 (10.7)	37 (5.9)	606 (10.1)
Hungary	37 (4.0)	528 (5.2)	57 (4.1)	541 (4.9)	6 (2.2)	551 (17.8)	0 (0.0)	~ ~
Iceland	r 36 (5.9)	478 (4.8)	64 (5.9)	497 (7.1)	0 (0.0)	~ ~	0 (0.0)	~ ~
Iran, Islamic Rep.	r 1 (0.9)	~ ~	26 (4.5)	428 (6.3)	54 (5.3)	431 (2.3)	19 (4.4)	424 (7.7)
Ireland	r 12 (2.7)	454 (8.5)	68 (4.5)	526 (6.7)	20 (3.9)	575 (9.5)	0 (0.0)	~ ~
Israel	r 14 (5.1)	495 (13.2)	36 (7.4)	524 (10.2)	49 (9.1)	529 (13.8)	2 (1.6)	~ ~
Japan	0 (0.2)	~ ~	4 (1.4)	598 (8.5)	88 (2.0)	600 (2.2)	8 (1.5)	667 (10.1)
Korea	2 (1.2)	~ ~	1 (1.0)	~ ~	4 (1.5)	562 (6.6)	93 (2.0)	611 (2.6)
Kuwait	0 (0.0)	~ ~	49 (6.5)	395 (2.9)	49 (6.3)	390 (4.3)	2 (1.9)	~ ~
Latvia (LSS)	r 41 (4.0)	482 (5.1)	51 (3.8)	501 (4.3)	4 (2.1)	502 (23.4)	4 (2.0)	469 (11.4)
Lithuania	r 43 (3.8)	461 (4.8)	54 (3.7)	491 (5.7)	3 (1.6)	502 (21.1)	0 (0.0)	~ ~
Netherlands	16 (4.7)	467 (21.0)	77 (5.6)	549 (6.5)	7 (3.6)	631 (18.1)	0 (0.0)	~ ~
New Zealand	11 (2.2)	460 (6.8)	68 (3.8)	508 (5.8)	21 (3.1)	536 (9.0)	0 (0.0)	~ ~
Norway	r 20 (3.5)	499 (6.2)	79 (3.7)	510 (2.9)	1 (0.5)	~ ~	1 (0.8)	~ ~
Portugal	12 (2.8)	440 (4.4)	80 (3.7)	456 (3.1)	7 (2.6)	469 (12.1)	0 (0.0)	~ ~
Romania	23 (2.7)	462 (7.9)	51 (4.3)	470 (5.3)	24 (4.1)	516 (9.0)	2 (1.2)	~ ~
Russian Federation	15 (2.7)	514 (12.1)	75 (3.6)	539 (5.8)	9 (2.3)	544 (8.6)	0 (0.0)	~ ~
Scotland	r 12 (2.8)	455 (11.6)	80 (3.8)	496 (6.9)	8 (2.7)	543 (18.4)	0 (0.0)	~ ~
Singapore	1 (0.7)	~ ~	10 (2.5)	645 (13.2)	72 (4.3)	640 (6.2)	18 (4.0)	656 (8.8)
Slovak Republic	15 (2.8)	526 (8.5)	67 (4.2)	546 (4.1)	19 (3.6)	556 (8.5)	0 (0.0)	~ ~
Slovenia	r 15 (3.1)	513 (6.8)	80 (3.6)	545 (4.0)	5 (1.8)	554 (18.5)	0 (0.0)	~ ~
Spain	r 13 (2.8)	470 (5.9)	48 (4.0)	484 (4.5)	36 (4.2)	497 (4.6)	4 (1.7)	476 (10.9)
Sweden	r 36 (3.9)	492 (5.8)	61 (4.0)	534 (3.9)	2 (1.2)	~ ~	0 (0.0)	~ ~
Switzerland	s 56 (4.5)	543 (8.1)	44 (4.5)	565 (6.6)	0 (0.0)	~ ~	0 (0.0)	~ ~
Thailand	x x	x x	x x	x x	x x	x x	x x	x x
United States	s 24 (3.0)	504 (9.6)	59 (3.9)	507 (5.7)	12 (2.2)	506 (17.0)	4 (1.8)	490 (22.3)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 5.3 provides a pictorial view of the emphasis on individual, small-group, and whole-class work as reported by the mathematics teachers in the TIMSS countries. Because learning may be enhanced with teacher guidance and monitoring individual and small-group activities, the frequency of lessons using each of these organizational approaches is shown both with and without assistance of the teacher. Internationally, teachers reported that students working together as a class with the teacher teaching the whole class is a frequently used instructional approach. In most countries, approximately 50% or even more of the eighth-grade students were taught this way during most or every lesson. In contrast, students working together as a class and responding to each other appeared to be a much less common approach, used for a third or fewer of the students on a frequent basis (except in Israel).

Equally as popular as having students working together as a class with the teacher teaching the whole class, was having students work individually with assistance from the teacher. Group work was reported to be the least frequent approach, but when such an approach was indicated, it was more often with than without the assistance of the teacher. In general, having students work without the assistance of the teacher, either individually or in groups, was not common in most countries, except Israel and possibly Latvia (LSS).

Figure 5.3

Teachers' Reports About Classroom Organization During Mathematics Lessons
Upper Grade (Eighth Grade*)

Country	Percent of Students Whose Teachers Report Using Each Organizational Approach "Most or Every Lesson"					
	Work Together as a Class with Students Responding to One Another	Work Together as a Class with Teacher Teaching the Whole Class	Work Individually with Assistance from Teacher	Work Individually without Assistance from Teacher	Work in Pairs or Small Groups with Assistance from Teacher	Work in Pairs or Small Groups without Assistance from Teacher
Australia	r 14	r 46	r 64	r 27	r 25	r 9
Austria	r 6	r 52	r 51	r 23	r 19	r 7
Belgium (Fl)	10	59	57	36	6	5
Belgium (Fr)	s 7	s 38	s 55	s 29	s 11	s 5
Canada	r 12	37	57	r 25	r 28	r 14
Colombia	25	41	55	r 19	44	r 22
Cyprus	r 13	r 61	r 73	r 23	r 26	r 9
Czech Republic	5	47	72	42	13	8
Denmark	5	41	74	16	18	4
England	s 19	s 46	s 57	s 25	s 14	s 8
France	11	48	56	26	17	4
Germany	s 23	s 70	s 54	s 15	s 20	s 9
Greece	4	58	60	18	14	3
Hong Kong	11	37	62	17	9	4
Hungary	11	60	65	22	7	1
Iceland	r 2	r 39	r 82	r 38	r 32	r 17
Iran, Islamic Rep.	33	66	55	8	42	10
Ireland	r 7	67	47	37	r 9	r 6
Israel	r 70	r 65	r 35	r 68	r 51	r 62
Japan	22	78	27	15	7	1

Percent for "Most or Every Lesson" → ◐

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*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 5.3 (Continued)

Teachers' Reports About Classroom Organization During Mathematics Lessons Upper Grade (Eighth Grade*)

Country	Percent of Students Whose Teachers Report Using Each Organizational Approach "Most or Every Lesson"					
	Work Together as a Class with Students Responding to One Another	Work Together as a Class with Teacher Teaching the Whole Class	Work Individually with Assistance from Teacher	Work Individually without Assistance from Teacher	Work in Pairs or Small Groups with Assistance from Teacher	Work in Pairs or Small Groups without Assistance from Teacher
Korea	39	89	41	30	12	11
Kuwait	3	34	48	14	7	5
Latvia (LSS)	24	86	90	r 55	28	r 11
Lithuania	10	55	72	25	32	10
Netherlands	7	56	65	38	49	34
New Zealand	19	52	63	28	25	14
Norway	r 17	r 58	r 71	s 4	r 36	s 6
Portugal	10	67	69	5	50	4
Romania	12	86	56	19	18	3
Russian Federation	6	66	65	37	22	13
Scotland	r 5	r 34	r 62	r 28	r 7	r 3
Singapore	15	61	48	27	20	6
Slovak Republic	35	47	50	31	8	7
Slovenia	r 11	r 60	r 87	r 34	r 40	r 11
Spain	r 15	r 68	r 58	r 24	r 15	r 10
Sweden	r 24	r 50	r 72	r 1	r 43	r 5
Switzerland	s 4	s 48	s 61	s 25	s 35	s 20
Thailand	r 19	s 58	r 41	r 18	r 22	r 5
United States	r 22	r 49	r 50	r 19	r 26	r 12

Percent for "Most or Every Lesson" →

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*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

WHAT ACTIVITIES DO STUDENTS DO IN THEIR MATHEMATICS LESSONS?

As shown in Table 5.9, mathematics teachers in the participating countries generally reported heavier reliance on curriculum guides than textbooks or examination specifications in deciding which topics to teach. Only Japan, Korea, the Netherlands, Sweden, and Thailand used textbooks more for this purpose than both other sources of information. In contrast, in almost all countries, the textbook was the major written source mathematics teachers used in deciding how to present a topic to their classes. Internationally, the textbook appears to play a role in mathematics classrooms in many countries. For nearly all students in all countries, teachers reported using a textbook in their mathematics classes (see Figure 5.4).

The types of activities teachers asked eighth-grade students to do, however, varied from country to country. Teachers were asked how often they asked students to practice computational skills, and the responses are shown in Table 5.10. It appears that in most countries, the majority of the students practice computation in most or every lesson.

The data in Table 5.11 reveal that the majority of students in most countries were asked to do some type of mathematics reasoning tasks in most or every lesson. The activities TIMSS asked about included explaining the reasoning behind an idea, using tables, charts, or graphs to represent and analyze relationships, working on problems for which there is no immediately obvious solution, and/or writing equations to represent relationships. In Cyprus, Romania, and the Russian Federation, 55% or more of the students were asked to do at least one of these types of reasoning tasks in every lesson.

Teachers were not asked about the emphasis placed on using things from everyday life in solving mathematics problems, but students were (see Table 5.12). According to eighth-grade students, only a moderate emphasis is placed on doing these types of problems in mathematics class. Only in Canada, Cyprus, England, Greece, Iran, Latvia(LSS), New Zealand, Spain, and the United States did more than 50% of the students report being asked to do such problems on a frequent basis (pretty often or almost always).

Table 5.9

Teachers' Reports on Their Main Sources of Written Information When Deciding Which Topics to Teach and How to Present a Topic Mathematics - Upper Grade (Eighth Grade*)[1]

Country	Percent of Students Taught by Teachers					
	Deciding Which Topics to Teach			Deciding How to Present a Topic		
	Curriculum Guide	Textbook	Examination Specifications	Curriculum Guide	Textbook	Examination Specifications
Australia	r 91 (2.0)	9 (2.0)	- -	r 13 (2.4)	87 (2.4)	- -
Austria	r 75 (4.2)	25 (4.2)	0 (0.2)	r 28 (3.9)	72 (3.8)	0 (0.2)
Belgium (Fl)	92 (2.7)	8 (2.7)	- -	r 8 (2.3)	92 (2.3)	- -
Belgium (Fr)	s 87 (4.6)	13 (4.6)	- -	s 2 (1.4)	98 (1.4)	- -
Canada	- -	- -	- -	- -	- -	- -
Colombia	r 63 (5.2)	35 (5.1)	3 (1.3)	r 43 (5.9)	56 (5.8)	1 (0.7)
Cyprus	r 67 (5.7)	33 (5.7)	0 (0.0)	r 17 (4.3)	83 (4.3)	0 (0.0)
Czech Republic	79 (4.6)	21 (4.6)	- -	9 (3.4)	91 (3.4)	- -
Denmark	- -	- -	- -	- -	- -	- -
England	- -	- -	- -	- -	- -	- -
France	89 (2.6)	10 (2.4)	1 (0.9)	r 13 (2.9)	87 (2.9)	0 (0.0)
Germany	s 80 (4.1)	20 (4.1)	- -	s 25 (5.4)	75 (5.4)	- -
Greece	53 (4.1)	47 (4.1)	- -	5 (1.9)	95 (1.9)	- -
Hong Kong	61 (6.3)	30 (6.0)	9 (2.2)	15 (4.5)	85 (4.5)	0 (0.0)
Hungary	79 (3.1)	19 (3.1)	2 (1.3)	18 (3.2)	81 (3.1)	1 (0.8)
Iceland	s 63 (8.1)	36 (8.1)	1 (0.1)	s 12 (3.9)	87 (4.0)	1 (0.1)
Iran, Islamic Rep.	r 64 (4.9)	31 (4.7)	5 (2.1)	r 55 (5.9)	36 (5.6)	9 (2.7)
Ireland	r 65 (4.8)	35 (4.8)	- -	r 14 (3.6)	86 (3.6)	- -
Israel	r 91 (4.9)	5 (3.1)	5 (3.6)	r 28 (6.5)	69 (7.2)	3 (3.3)
Japan	24 (3.4)	74 (3.5)	1 (1.1)	11 (2.4)	87 (2.8)	2 (1.4)
Korea	22 (3.4)	76 (3.6)	2 (1.1)	22 (3.2)	74 (3.5)	4 (1.7)
Kuwait	- -	- -	- -	- -	- -	- -
Latvia (LSS)	r 81 (4.0)	16 (3.7)	3 (1.5)	r 17 (3.2)	80 (3.8)	4 (1.8)
Lithuania	r 88 (3.1)	10 (2.8)	2 (1.3)	r 6 (2.3)	93 (2.2)	1 (0.9)
Netherlands	2 (1.3)	87 (4.0)	12 (3.8)	1 (0.8)	94 (2.8)	5 (2.7)
New Zealand	91 (2.6)	5 (1.9)	4 (1.7)	47 (4.3)	53 (4.3)	0 (0.0)
Norway	r 53 (4.8)	47 (4.8)	- -	s 9 (2.9)	91 (2.9)	- -
Portugal	86 (3.1)	14 (3.1)	- -	64 (4.9)	36 (4.9)	- -
Romania	94 (2.2)	3 (1.5)	3 (1.6)	28 (3.7)	67 (3.8)	5 (2.1)
Russian Federation	76 (4.4)	13 (2.8)	11 (3.2)	7 (2.5)	86 (3.6)	6 (2.7)
Scotland	s 79 (4.3)	10 (3.5)	11 (3.6)	s 28 (4.7)	68 (5.1)	4 (2.9)
Singapore	82 (3.5)	18 (3.5)	0 (0.2)	10 (2.8)	89 (2.8)	1 (0.4)
Slovak Republic	83 (3.6)	17 (3.6)	0 (0.0)	16 (3.0)	83 (3.1)	1 (0.8)
Slovenia	r 87 (3.7)	9 (3.1)	4 (2.0)	r 27 (4.5)	71 (4.8)	2 (1.6)
Spain	- -	- -	- -	- -	- -	- -
Sweden	r 46 (3.8)	54 (3.8)	- -	r 6 (1.7)	94 (1.7)	- -
Switzerland	s 69 (4.6)	30 (4.6)	1 (0.6)	x x	x x	x x
Thailand	s 44 (6.3)	50 (6.4)	6 (3.3)	r 17 (4.5)	83 (4.5)	0 (0.0)
United States	s 64 (3.7)	30 (3.3)	6 (1.3)	s 9 (2.3)	88 (2.4)	3 (1.2)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Curriculum Guides include national, regional, and school curriculum guides; Textbooks include teacher and student editions, as well as other resource books; and Examination Specifications include national and regional levels.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

An "x" indicates teacher response data available for <50% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Figure 5.4

Teachers' Reports About Using a Textbook in Teaching Mathematics Upper Grade (Eighth Grade*)

Countries are classified by percentage of students whose teachers reported that they use a textbook in teaching their mathematics class.

[r]*Austria*
[r]**Cyprus**
Czech Republic
[s]**England**
Hong Kong
Hungary
[r]**Iceland**
[r]*Israel*
Japan
Korea
[r]**Latvia (LSS)**
Netherlands
[r]**Norway**
Romania
Russian Federation
Singapore
[r]**Sweden**

100%

Canada
Denmark
France
[s]*Germany*
Greece
Iran, Islamic Rep.
Ireland
Kuwait
Lithuania
Portugal
[r]*Scotland*
[r]*Slovenia*
[s]**Switzerland**
[s]*Thailand*
[r]**United States**

95-99%

[r]*Australia*
[r]**Belgium(Fl)**
New Zealand
[r]**Spain**

85-94%

Note: Seventy percent of students in Colombia, and 49 percent in [r]Belgium (French) had teachers who reported using a textbook in their mathematics class.

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[*] Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.
Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.
An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.
The Slovak Republic did not ask this question.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.10

Teachers' Reports on How Often They Ask Students to Practice Computational Skills Mathematics - Upper Grade (Eighth Grade*)

Country	Never or Almost Never		Some Lessons		Most Lessons		Every Lesson	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	r 10 (2.2)	527 (16.0)	40 (3.4)	544 (7.0)	38 (3.5)	529 (7.0)	13 (2.2)	507 (14.1)
Austria	r 3 (1.7)	607 (12.8)	27 (3.6)	568 (7.3)	49 (3.7)	546 (7.0)	21 (2.7)	517 (10.3)
Belgium (Fl)	0 (0.0)	~ ~	33 (3.8)	603 (6.6)	49 (4.7)	574 (7.9)	18 (3.8)	524 (17.4)
Belgium (Fr)	s 4 (4.0)	553 (0.0)	28 (5.2)	530 (8.4)	52 (6.0)	548 (6.6)	16 (4.4)	551 (15.3)
Canada	4 (1.7)	529 (5.1)	36 (4.0)	527 (6.2)	42 (4.1)	531 (5.6)	18 (2.8)	525 (11.2)
Colombia	2 (1.2)	~ ~	13 (2.9)	391 (8.7)	50 (5.0)	383 (3.9)	35 (5.0)	391 (9.1)
Cyprus	r 5 (1.3)	490 (24.7)	38 (5.3)	464 (4.8)	43 (5.3)	469 (3.8)	15 (4.1)	477 (11.2)
Czech Republic	0 (0.0)	~ ~	23 (4.8)	558 (7.6)	37 (4.6)	567 (8.3)	40 (5.2)	559 (8.2)
Denmark	2 (1.4)	~ ~	51 (4.1)	507 (4.1)	42 (4.3)	500 (3.6)	6 (2.1)	497 (14.9)
England	s 7 (1.6)	542 (20.8)	52 (2.6)	515 (6.0)	34 (2.8)	506 (8.0)	8 (1.9)	539 (17.3)
France	6 (2.1)	534 (10.2)	44 (4.8)	549 (4.5)	44 (4.2)	536 (5.4)	7 (2.1)	517 (15.7)
Germany	s 17 (3.3)	479 (12.1)	51 (5.0)	522 (8.4)	25 (4.4)	525 (11.2)	7 (2.8)	501 (26.4)
Greece	7 (2.0)	456 (9.6)	52 (4.3)	482 (4.8)	33 (3.8)	491 (4.5)	8 (2.1)	491 (11.8)
Hong Kong	21 (5.3)	591 (16.1)	23 (4.9)	598 (16.9)	35 (5.1)	575 (13.2)	21 (4.4)	595 (15.4)
Hungary	0 (0.0)	~ ~	13 (3.1)	543 (10.8)	51 (4.3)	536 (5.1)	35 (4.3)	537 (5.5)
Iceland	r 0 (0.0)	~ ~	12 (4.4)	489 (6.5)	40 (6.1)	479 (6.9)	49 (6.7)	498 (7.7)
Iran, Islamic Rep.	7 (2.8)	416 (14.3)	51 (5.6)	431 (2.3)	29 (5.3)	432 (3.8)	13 (3.3)	432 (6.9)
Ireland	19 (3.9)	524 (14.8)	29 (4.2)	527 (10.7)	37 (4.5)	527 (9.7)	15 (3.1)	531 (19.1)
Israel	r 18 (5.9)	518 (18.9)	36 (7.4)	520 (11.2)	41 (6.3)	522 (12.8)	4 (2.6)	545 (44.6)
Japan	- -	- -	- -	- -	- -	- -	- -	- -
Korea	19 (3.4)	610 (5.9)	53 (4.3)	609 (3.7)	24 (4.0)	613 (5.3)	4 (1.3)	603 (10.8)
Kuwait	1 (0.6)	~ ~	28 (7.3)	390 (3.6)	51 (8.1)	391 (2.9)	20 (5.3)	393 (5.9)
Latvia (LSS)	- -	- -	- -	- -	- -	- -	- -	- -
Lithuania	0 (0.0)	~ ~	2 (1.0)	~ ~	30 (3.7)	482 (7.5)	68 (3.9)	476 (4.7)
Netherlands	- -	- -	- -	- -	- -	- -	- -	- -
New Zealand	7 (2.3)	519 (17.9)	45 (3.8)	509 (6.2)	40 (3.6)	505 (6.4)	7 (2.2)	509 (21.2)
Norway	r 5 (2.0)	506 (7.9)	59 (4.4)	505 (3.4)	34 (4.4)	509 (4.5)	2 (1.2)	~ ~
Portugal	- -	- -	- -	- -	- -	- -	- -	- -
Romania	0 (0.0)	~ ~	12 (2.6)	476 (15.0)	35 (4.1)	482 (8.4)	53 (4.4)	483 (6.2)
Russian Federation	0 (0.4)	~ ~	13 (2.3)	517 (12.4)	43 (3.6)	545 (9.0)	44 (3.5)	530 (7.9)
Scotland	- -	- -	- -	- -	- -	- -	- -	- -
Singapore	20 (3.7)	645 (11.6)	30 (4.2)	644 (9.4)	36 (4.4)	639 (7.4)	13 (3.3)	652 (15.2)
Slovak Republic	3 (1.3)	533 (16.2)	35 (4.6)	545 (6.3)	36 (4.2)	550 (5.7)	27 (4.1)	541 (5.8)
Slovenia	r 0 (0.0)	~ ~	21 (4.3)	535 (8.2)	36 (5.5)	551 (6.0)	43 (5.4)	533 (4.8)
Spain	r 30 (4.1)	481 (4.8)	42 (4.8)	490 (4.3)	23 (4.3)	491 (7.3)	4 (2.4)	477 (7.0)
Sweden	r 2 (0.9)	~ ~	18 (2.6)	512 (6.8)	51 (3.7)	523 (4.5)	29 (3.6)	515 (6.6)
Switzerland	s 4 (1.9)	545 (30.8)	21 (4.0)	560 (18.4)	59 (5.0)	552 (5.9)	16 (3.7)	548 (12.4)
Thailand	r 0 (0.0)	~ ~	13 (4.7)	547 (20.4)	42 (5.9)	519 (10.1)	45 (6.5)	529 (9.6)
United States	r 11 (1.9)	536 (12.9)	31 (3.4)	510 (9.2)	38 (4.4)	485 (6.2)	21 (3.9)	499 (10.4)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.11

Teachers' Reports on How Often They Ask Students to Do Reasoning Tasks[1] Mathematics - Upper Grade (Eighth Grade*)

Country	Never or Almost Never		Some Lessons		Most Lessons		Every Lesson	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	r 1 (0.9)	~ ~	38 (3.0)	520 (8.6)	48 (3.2)	538 (6.0)	13 (2.4)	547 (8.5)
Austria	r 0 (0.0)	~ ~	25 (3.4)	539 (10.2)	57 (4.5)	548 (6.4)	18 (3.4)	561 (10.3)
Belgium (Fl)	0 (0.3)	~ ~	25 (4.3)	549 (13.7)	56 (4.7)	577 (8.4)	19 (3.4)	604 (9.2)
Belgium (Fr)	s 0 (0.0)	~ ~	21 (4.3)	531 (8.7)	48 (6.1)	542 (6.1)	31 (5.7)	556 (9.3)
Canada	0 (0.0)	~ ~	19 (3.0)	527 (8.1)	62 (3.8)	529 (4.0)	19 (3.6)	529 (8.7)
Colombia	0 (0.0)	~ ~	18 (3.5)	377 (4.4)	56 (5.1)	392 (3.4)	26 (5.0)	382 (11.7)
Cyprus	r 0 (0.0)	~ ~	4 (2.2)	468 (41.8)	39 (4.8)	469 (5.6)	58 (5.2)	471 (2.8)
Czech Republic	0 (0.0)	~ ~	9 (3.4)	570 (20.6)	56 (5.5)	558 (7.3)	36 (5.1)	566 (8.0)
Denmark	4 (2.6)	477 (8.1)	59 (4.8)	507 (3.4)	31 (4.5)	504 (4.3)	5 (2.3)	500 (16.6)
England	s 0 (0.0)	~ ~	25 (2.7)	506 (9.5)	60 (3.0)	518 (5.4)	14 (2.1)	524 (12.3)
France	0 (0.0)	~ ~	32 (4.3)	528 (5.2)	48 (4.7)	550 (5.5)	20 (3.8)	537 (9.9)
Germany	s 1 (1.0)	~ ~	24 (4.4)	515 (13.5)	58 (4.8)	518 (7.6)	17 (3.9)	510 (11.4)
Greece	1 (0.6)	~ ~	15 (2.9)	475 (6.7)	47 (4.1)	485 (4.8)	37 (3.9)	488 (6.4)
Hong Kong	1 (1.2)	~ ~	33 (5.5)	595 (12.6)	58 (5.6)	585 (9.8)	8 (3.2)	578 (28.7)
Hungary	0 (0.0)	~ ~	8 (2.4)	502 (6.6)	54 (4.6)	538 (5.2)	38 (4.5)	543 (5.8)
Iceland	r 1 (1.3)	~ ~	72 (6.4)	489 (5.1)	22 (5.9)	497 (15.0)	5 (2.3)	468 (19.5)
Iran, Islamic Rep.	0 (0.0)	~ ~	30 (6.3)	427 (5.6)	47 (6.0)	429 (3.0)	23 (4.5)	434 (4.0)
Ireland	1 (0.6)	~ ~	55 (4.8)	525 (8.1)	33 (4.3)	520 (8.8)	12 (3.3)	562 (18.0)
Israel	r 3 (2.7)	474 (0.0)	9 (4.3)	532 (12.5)	68 (8.1)	528 (9.9)	20 (5.9)	502 (15.7)
Japan	0 (0.0)	~ ~	7 (2.2)	594 (5.1)	55 (4.4)	604 (2.9)	37 (4.3)	608 (4.4)
Korea	1 (0.7)	~ ~	3 (1.5)	640 (9.6)	72 (3.7)	608 (3.0)	24 (3.4)	612 (6.8)
Kuwait	2 (2.4)	~ ~	49 (6.5)	392 (3.5)	41 (6.1)	392 (2.9)	8 (4.1)	386 (3.3)
Latvia (LSS)	r 0 (0.0)	~ ~	16 (3.6)	482 (8.6)	60 (4.8)	490 (4.2)	24 (4.4)	499 (7.1)
Lithuania	0 (0.0)	~ ~	15 (2.8)	467 (10.6)	59 (4.4)	475 (5.5)	26 (4.0)	490 (6.4)
Netherlands	- -	- -	- -	- -	- -	- -	- -	- -
New Zealand	0 (0.0)	~ ~	35 (3.4)	493 (6.9)	53 (3.9)	514 (6.6)	12 (2.7)	525 (12.7)
Norway	r 0 (0.0)	~ ~	47 (4.4)	506 (4.0)	48 (4.3)	508 (3.6)	5 (2.2)	509 (13.0)
Portugal	0 (0.0)	~ ~	16 (3.1)	454 (5.7)	66 (4.0)	454 (3.1)	18 (3.5)	456 (6.5)
Romania	0 (0.0)	~ ~	5 (1.7)	444 (21.5)	22 (3.2)	476 (9.4)	74 (3.4)	486 (4.9)
Russian Federation	0 (0.0)	~ ~	6 (1.9)	508 (13.3)	39 (4.0)	525 (6.1)	55 (4.8)	545 (7.0)
Scotland	- -	- -	- -	- -	- -	- -	- -	- -
Singapore	0 (0.0)	~ ~	34 (4.1)	637 (9.5)	57 (4.5)	648 (6.2)	8 (2.3)	642 (20.7)
Slovak Republic	0 (0.0)	~ ~	5 (2.0)	531 (7.2)	66 (4.0)	545 (4.0)	29 (3.9)	548 (5.7)
Slovenia	r 0 (0.0)	~ ~	13 (3.4)	537 (7.0)	77 (4.6)	541 (4.2)	10 (3.2)	539 (6.9)
Spain	r 0 (0.0)	~ ~	15 (3.3)	469 (5.2)	67 (4.2)	488 (3.5)	18 (3.3)	497 (6.2)
Sweden	r 1 (0.5)	~ ~	35 (3.8)	515 (6.6)	46 (3.7)	520 (4.0)	18 (2.8)	523 (7.5)
Switzerland	s 2 (1.6)	~ ~	31 (4.7)	538 (12.0)	52 (5.0)	556 (7.3)	15 (3.2)	583 (8.9)
Thailand	r 0 (0.0)	~ ~	49 (6.7)	526 (11.5)	34 (6.2)	521 (10.7)	17 (4.7)	544 (11.3)
United States	r 0 (0.0)	~ ~	24 (3.4)	495 (0.0)	50 (3.5)	498 (5.9)	26 (3.3)	514 (10.2)

Based on most frequent response for: explain reasoning behind an idea; represent and analyze relationships using tables, charts or graphs; work on problems for which there is no immediately obvious method of solution; and write equations to represent relationships.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.12

Students' Reports on Frequency of Using Things from Everyday Life in Solving Mathematics Problems - Upper Grade (Eighth Grade*)

Country	Never		Once in a While		Pretty Often		Almost Always	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	14 (0.6)	512 (5.4)	39 (0.9)	543 (3.9)	34 (0.8)	536 (4.7)	13 (0.6)	513 (5.5)
Austria	21 (1.1)	536 (4.6)	44 (1.2)	546 (4.1)	23 (0.8)	545 (4.8)	12 (0.8)	519 (6.3)
Belgium (Fl)	34 (1.5)	563 (5.0)	41 (1.4)	576 (7.8)	20 (1.0)	567 (5.6)	5 (0.5)	512 (10.2)
Belgium (Fr)	39 (1.5)	525 (4.4)	39 (1.4)	543 (4.1)	15 (1.0)	514 (7.7)	8 (0.7)	510 (11.8)
Canada	13 (1.0)	528 (6.9)	36 (0.8)	534 (2.3)	34 (1.0)	530 (3.3)	17 (0.6)	517 (3.9)
Colombia	20 (1.6)	386 (4.9)	32 (1.5)	392 (4.5)	23 (1.0)	392 (4.5)	25 (1.2)	382 (5.5)
Cyprus	18 (1.0)	464 (3.6)	28 (0.9)	483 (3.4)	38 (1.0)	481 (3.5)	16 (0.9)	462 (4.4)
Czech Republic	16 (0.8)	553 (5.6)	41 (1.1)	565 (5.8)	34 (1.3)	573 (5.5)	9 (0.6)	552 (8.3)
Denmark	28 (1.3)	494 (4.7)	51 (1.5)	510 (3.5)	16 (1.3)	508 (5.2)	5 (0.5)	485 (11.0)
England	11 (0.9)	509 (7.4)	36 (1.2)	508 (4.3)	41 (1.3)	512 (2.7)	12 (0.8)	487 (6.9)
France	24 (1.5)	526 (3.7)	38 (1.0)	543 (3.2)	26 (1.3)	549 (4.5)	12 (0.8)	536 (5.8)
Germany	26 (1.4)	505 (4.8)	45 (1.5)	519 (5.1)	19 (1.1)	511 (6.7)	10 (0.8)	488 (6.6)
Greece	16 (0.8)	467 (5.3)	28 (0.9)	482 (3.9)	36 (1.1)	496 (3.8)	20 (0.7)	484 (4.3)
Hong Kong	26 (1.3)	578 (7.8)	45 (1.1)	599 (6.7)	20 (0.9)	593 (7.2)	8 (0.6)	570 (10.7)
Hungary	29 (1.2)	537 (4.5)	48 (1.2)	545 (4.0)	18 (0.8)	534 (6.3)	6 (0.5)	508 (9.7)
Iceland	35 (2.6)	491 (6.4)	36 (2.4)	497 (4.8)	21 (1.3)	482 (6.9)	8 (1.2)	451 (10.6)
Iran, Islamic Rep.	15 (0.9)	424 (5.6)	24 (1.0)	429 (4.1)	28 (1.2)	432 (2.5)	33 (1.0)	432 (3.4)
Ireland	39 (1.3)	529 (5.0)	33 (0.9)	543 (5.6)	18 (0.9)	524 (7.2)	9 (0.7)	495 (7.5)
Israel	19 (1.9)	527 (10.7)	41 (1.5)	533 (8.6)	23 (1.5)	516 (6.3)	16 (1.1)	511 (6.7)
Japan	25 (1.1)	594 (3.8)	57 (0.9)	608 (2.1)	16 (0.8)	612 (3.4)	2 (0.2)	~ ~
Korea	31 (1.1)	604 (3.4)	50 (1.0)	613 (3.3)	13 (0.7)	613 (6.7)	5 (0.5)	571 (10.8)
Kuwait	22 (1.5)	399 (3.9)	35 (1.6)	396 (2.8)	23 (1.5)	390 (3.3)	21 (1.7)	381 (3.6)
Latvia (LSS)	8 (0.9)	494 (7.2)	18 (0.9)	498 (5.3)	29 (1.0)	495 (4.0)	45 (1.4)	492 (3.9)
Lithuania	20 (1.0)	479 (5.1)	39 (1.0)	481 (4.1)	27 (1.1)	480 (4.8)	14 (0.8)	466 (6.4)
Netherlands	27 (1.5)	522 (10.0)	48 (1.5)	549 (6.1)	17 (1.1)	558 (7.1)	8 (0.7)	545 (11.1)
New Zealand	8 (0.6)	488 (7.1)	38 (1.0)	516 (5.1)	39 (1.1)	512 (4.7)	15 (0.7)	495 (5.9)
Norway	31 (1.2)	493 (3.1)	46 (1.1)	508 (2.5)	18 (0.9)	522 (4.5)	6 (0.5)	487 (8.2)
Portugal	20 (0.9)	457 (3.5)	36 (1.0)	459 (3.1)	24 (0.9)	452 (3.4)	20 (0.9)	448 (3.2)
Romania	15 (0.8)	483 (5.9)	41 (1.2)	492 (4.9)	23 (0.8)	479 (5.2)	21 (0.9)	469 (5.2)
Russian Federation	17 (1.1)	532 (5.0)	52 (1.2)	542 (5.0)	21 (1.6)	541 (9.4)	9 (0.8)	502 (8.5)
Scotland	17 (1.0)	492 (6.2)	35 (1.1)	511 (6.1)	33 (1.1)	502 (6.6)	15 (0.9)	479 (8.4)
Singapore	20 (0.9)	633 (6.3)	41 (1.0)	652 (5.2)	30 (0.9)	645 (5.7)	10 (0.5)	627 (5.9)
Slovak Republic	36 (1.6)	531 (3.7)	43 (1.2)	560 (4.4)	16 (0.9)	557 (5.3)	5 (0.5)	527 (11.2)
Slovenia	15 (0.9)	536 (4.1)	55 (1.2)	543 (3.8)	21 (0.9)	546 (5.0)	8 (0.8)	522 (7.0)
Spain	15 (1.0)	469 (3.6)	31 (1.1)	492 (2.7)	26 (1.0)	495 (2.8)	27 (1.1)	486 (3.1)
Sweden	29 (1.1)	509 (3.8)	41 (0.9)	525 (3.6)	23 (0.8)	525 (3.9)	7 (0.6)	517 (5.8)
Switzerland	17 (1.0)	543 (5.1)	51 (1.1)	552 (3.0)	25 (1.2)	549 (4.3)	7 (0.6)	523 (8.9)
Thailand	19 (0.8)	513 (5.4)	44 (0.9)	524 (5.3)	26 (0.9)	530 (8.1)	11 (0.7)	518 (7.5)
United States	14 (0.8)	491 (6.3)	34 (1.1)	515 (4.7)	31 (1.0)	504 (5.0)	21 (0.9)	481 (5.4)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

HOW ARE CALCULATORS AND COMPUTERS USED?

As shown in Table 5.13, nearly all eighth-grade students reported having a calculator in the home, except in Iran (61%), Romania (62%), and Thailand (68%). Internationally, fewer students reported a computer in the home, even though more than three-fourths did so in Denmark, England, Iceland, Ireland, Israel, the Netherlands, and Scotland. Between 50% and 75% so reported in Australia, Austria, Belgium (Flemish), Belgium (French), Canada, Germany, Kuwait, New Zealand, Norway, Sweden, Switzerland, and the United States. Fewer than 20% of the eighth-grade students reported home computers in Colombia, Iran, Latvia (LSS), Romania, and Thailand.

Table 5.14 provides teachers' reports about how often calculators are used in eighth-grade mathematics classes. Even though calculators appear to be widely available in most countries, teachers reported considerable variation from country to country in the frequency of calculator use in mathematics classrooms. Although using calculators can take the drudgery out of mathematics and free the learner to concentrate on higher-order problem-solving skills, another point of view is that permitting unrestricted use of calculators may damage students' mastery of basic skills in mathematics.

According to teachers in many of the TIMSS countries, three-fourths or more of the eighth-grade students use calculators almost every day in their mathematics classes. The exceptions to at least weekly usage for the majority of the students were Belgium (Flemish), Greece, Iran, Ireland, Japan, Korea, Romania, and Thailand. As revealed in Table 5.15, teachers reported that students use calculators for a variety of purposes. Across countries, no single use appears to predominate, although checking answers, routine computation, and solving complex problems are frequent purposes in many countries. Using calculators on tests and exams was often less frequent than other uses, ranging from 0% of the students in Japan and Thailand to 64% in Austria.

Students' reports about the frequency of calculator usage in mathematics classes are presented in Table 5.16. Because different response categories were used for the student and teacher versions of the question, a direct comparison is difficult. It does appear that fewer students than teachers indicated nearly always using calculators. However, combining the two most frequent categories for students (pretty often and almost always) and comparing those percentages of responses to the two most frequent response categories for teachers (almost every day and once or twice a week) yields a fair degree of agreement between teachers' and students' reports.

Table 5.17 contains teachers' reports about how often computers are used in mathematics class to solve exercises or problems, and Table 5.18 contains students' responses to a similar question. Internationally, substantial percentages of teachers and students agreed that the computer is almost never used in most students' mathematics lessons. Teachers and students agree on moderate use of computers (more than 20% of the students in some lessons) in Austria, Denmark, England, Sweden, and the United States.

Table 5.13

Students' Reports on Having a Calculator and Computer in the Home Mathematics - Upper Grade (Eighth Grade*)

Country	Calculator				Computer			
	Yes		No		Yes		No	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	97 (0.3)	533 (4.0)	3 (0.3)	447 (11.1)	73 (1.2)	539 (4.3)	27 (1.2)	510 (4.5)
Austria	100 (0.1)	540 (3.2)	0 (0.1)	~ ~	59 (1.5)	546 (3.5)	41 (1.5)	532 (4.0)
Belgium (Fl)	97 (0.8)	569 (5.2)	3 (0.8)	465 (20.2)	67 (1.3)	573 (5.8)	33 (1.3)	551 (6.3)
Belgium (Fr)	98 (0.3)	528 (3.4)	2 (0.3)	~ ~	60 (1.4)	538 (3.2)	40 (1.4)	511 (4.7)
Canada	98 (0.2)	529 (2.3)	2 (0.2)	~ ~	61 (1.3)	537 (2.4)	39 (1.3)	512 (3.2)
Colombia	88 (1.5)	389 (3.0)	12 (1.5)	356 (8.6)	11 (1.2)	405 (8.7)	89 (1.2)	382 (3.4)
Cyprus	96 (0.4)	477 (2.0)	4 (0.4)	418 (7.3)	39 (0.9)	484 (2.9)	61 (0.9)	469 (2.4)
Czech Republic	99 (0.2)	564 (4.9)	1 (0.2)	~ ~	36 (1.2)	579 (5.3)	64 (1.2)	555 (5.1)
Denmark	99 (0.3)	504 (2.9)	1 (0.3)	~ ~	76 (1.2)	508 (2.9)	24 (1.2)	490 (4.9)
England	99 (0.2)	508 (2.7)	1 (0.2)	~ ~	89 (0.8)	506 (3.1)	11 (0.8)	512 (8.2)
France	99 (0.2)	540 (3.1)	1 (0.2)	~ ~	50 (1.3)	547 (3.6)	50 (1.3)	531 (3.6)
Germany	99 (0.2)	510 (4.4)	1 (0.2)	~ ~	71 (1.0)	512 (4.3)	29 (1.0)	504 (5.6)
Greece	87 (0.6)	491 (3.0)	13 (0.6)	437 (4.6)	29 (1.0)	500 (5.3)	71 (1.0)	478 (2.8)
Hong Kong	99 (0.1)	590 (6.4)	1 (0.1)	~ ~	39 (1.9)	606 (7.2)	61 (1.9)	580 (6.5)
Hungary	97 (0.4)	541 (3.1)	3 (0.4)	457 (12.9)	37 (1.2)	569 (3.7)	63 (1.2)	521 (3.4)
Iceland	100 (0.1)	488 (4.5)	0 (0.1)	~ ~	77 (1.4)	488 (4.7)	23 (1.4)	483 (5.7)
Iran, Islamic Rep.	61 (1.8)	437 (2.2)	39 (1.8)	417 (2.9)	4 (0.4)	440 (6.9)	96 (0.4)	429 (2.1)
Ireland	97 (0.3)	529 (5.0)	3 (0.3)	497 (13.3)	78 (1.1)	531 (5.3)	22 (1.1)	521 (6.4)
Israel	99 (0.3)	524 (6.1)	1 (0.3)	~ ~	76 (2.1)	534 (5.8)	24 (2.1)	496 (9.1)
Japan	- -	- -	- -	- -	- -	- -	- -	- -
Korea	91 (0.5)	610 (2.5)	9 (0.5)	578 (8.1)	39 (1.2)	632 (3.6)	61 (1.2)	592 (2.8)
Kuwait	84 (1.4)	395 (2.5)	16 (1.4)	380 (3.6)	53 (2.1)	394 (3.4)	47 (2.1)	390 (2.8)
Latvia (LSS)	94 (0.5)	495 (3.1)	6 (0.5)	473 (8.1)	13 (0.9)	492 (5.6)	87 (0.9)	495 (3.1)
Lithuania	90 (1.0)	482 (3.6)	10 (1.0)	443 (6.3)	42 (1.4)	478 (3.9)	58 (1.4)	477 (4.2)
Netherlands	100 (0.1)	542 (7.0)	0 (0.1)	~ ~	85 (1.2)	545 (8.1)	15 (1.2)	524 (7.7)
New Zealand	99 (0.2)	509 (4.5)	1 (0.2)	~ ~	60 (1.3)	520 (5.0)	40 (1.3)	491 (4.6)
Norway	99 (0.2)	504 (2.2)	1 (0.2)	~ ~	64 (1.1)	512 (2.7)	36 (1.1)	489 (3.1)
Portugal	99 (0.2)	455 (2.5)	1 (0.2)	~ ~	39 (1.8)	469 (3.4)	61 (1.8)	446 (2.2)
Romania	62 (1.5)	491 (4.7)	38 (1.5)	467 (5.1)	19 (1.2)	496 (7.3)	81 (1.2)	479 (4.0)
Russian Federation	92 (0.8)	539 (5.0)	8 (0.8)	498 (10.8)	35 (1.5)	537 (5.6)	65 (1.5)	535 (6.2)
Scotland	98 (0.4)	500 (5.7)	2 (0.4)	~ ~	90 (0.6)	499 (5.8)	10 (0.6)	504 (7.4)
Singapore	100 (0.1)	644 (4.9)	0 (0.1)	~ ~	49 (1.5)	657 (5.1)	51 (1.5)	630 (5.0)
Slovak Republic	99 (0.2)	548 (3.3)	1 (0.2)	~ ~	31 (1.2)	563 (4.4)	69 (1.2)	540 (3.6)
Slovenia	98 (0.3)	542 (3.0)	2 (0.3)	~ ~	47 (1.3)	560 (3.7)	53 (1.3)	524 (3.4)
Spain	99 (0.2)	488 (2.0)	1 (0.2)	~ ~	42 (1.2)	499 (2.9)	58 (1.2)	479 (2.1)
Sweden	99 (0.1)	519 (2.9)	1 (0.1)	~ ~	60 (1.3)	531 (2.8)	40 (1.3)	500 (3.6)
Switzerland	99 (0.2)	547 (2.8)	1 (0.2)	~ ~	66 (1.2)	554 (3.1)	34 (1.2)	531 (3.8)
Thailand	68 (2.2)	530 (7.1)	32 (2.2)	508 (4.1)	4 (0.9)	573 (14.2)	96 (0.9)	521 (5.4)
United States	98 (0.3)	502 (4.5)	2 (0.3)	~ ~	59 (1.7)	518 (4.8)	41 (1.7)	474 (4.1)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.14

Teachers' Reports on Frequency of Students' Use of Calculators in Mathematics Class[1] Upper Grade (Eighth Grade*)

Country	Never or Hardly Ever		Once or Twice a Month		Once or Twice a Week		Almost Every Day	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	r 6 (2.0)	512 (26.3)	1 (0.7)	~ ~	10 (1.7)	511 (14.7)	83 (2.6)	537 (5.0)
Austria	r 2 (1.3)	~ ~	3 (1.7)	470 (14.6)	7 (2.1)	560 (17.4)	87 (3.1)	550 (4.2)
Belgium (Fl)	39 (4.9)	577 (12.1)	23 (3.9)	572 (16.4)	14 (3.8)	584 (15.6)	24 (3.5)	571 (6.4)
Belgium (Fr)	s 18 (5.1)	553 (11.0)	25 (5.0)	551 (9.9)	27 (4.9)	537 (8.7)	30 (5.5)	543 (9.2)
Canada	5 (1.4)	489 (17.5)	3 (0.9)	515 (13.1)	12 (2.5)	518 (9.9)	80 (2.8)	533 (3.8)
Colombia	33 (4.6)	383 (4.0)	11 (2.7)	397 (8.9)	22 (4.7)	401 (17.5)	34 (4.7)	377 (3.5)
Cyprus	r 27 (4.6)	471 (6.4)	8 (2.5)	464 (4.3)	21 (4.1)	463 (6.9)	44 (5.2)	475 (4.3)
Czech Republic	3 (1.9)	523 (19.8)	6 (2.3)	552 (17.5)	17 (4.4)	566 (9.2)	74 (4.9)	563 (5.7)
Denmark	28 (4.9)	502 (5.6)	15 (3.6)	503 (7.6)	18 (3.7)	507 (6.2)	39 (4.9)	507 (4.1)
England	s 0 (0.0)	~ ~	2 (0.7)	~ ~	15 (2.2)	479 (9.8)	83 (2.2)	523 (4.5)
France	4 (2.0)	537 (21.7)	3 (1.6)	565 (23.3)	19 (3.4)	538 (6.0)	74 (4.2)	537 (4.1)
Germany	s 19 (3.8)	511 (9.8)	5 (2.4)	579 (25.4)	15 (3.2)	526 (19.4)	62 (4.5)	508 (7.0)
Greece	46 (4.1)	486 (3.8)	23 (4.1)	475 (7.3)	12 (2.4)	483 (9.1)	19 (3.6)	490 (6.0)
Hong Kong	8 (3.0)	558 (38.8)	7 (2.9)	581 (21.4)	18 (3.7)	555 (18.4)	67 (4.9)	601 (8.0)
Hungary	29 (3.8)	533 (7.5)	5 (1.9)	512 (18.3)	6 (1.9)	534 (16.8)	60 (4.2)	540 (4.9)
Iceland	r 0 (0.0)	~ ~	0 (0.0)	~ ~	4 (1.8)	476 (15.8)	96 (1.8)	490 (5.2)
Iran, Islamic Rep.	54 (5.9)	422 (3.4)	32 (5.9)	437 (2.3)	9 (2.6)	432 (8.7)	5 (2.0)	442 (5.8)
Ireland	68 (4.6)	535 (8.0)	7 (2.3)	490 (15.9)	13 (3.5)	515 (16.2)	11 (3.2)	521 (16.6)
Israel	r 11 (5.7)	501 (9.0)	5 (3.7)	588 (34.8)	11 (4.6)	517 (34.6)	73 (6.9)	518 (7.6)
Japan	79 (3.7)	603 (2.9)	16 (3.4)	609 (9.1)	4 (1.6)	620 (22.6)	2 (1.2)	~ ~
Korea	76 (4.1)	613 (2.9)	16 (3.5)	608 (7.3)	8 (2.7)	585 (6.8)	1 (0.6)	~ ~
Kuwait	23 (4.4)	400 (5.5)	11 (2.9)	396 (6.5)	23 (7.2)	390 (4.3)	43 (7.9)	388 (3.2)
Latvia (LSS)	r 13 (3.0)	499 (7.8)	13 (3.6)	479 (8.6)	27 (4.4)	492 (7.1)	46 (4.9)	492 (5.2)
Lithuania	r 12 (2.9)	453 (10.8)	6 (2.2)	496 (22.0)	20 (3.7)	461 (9.0)	62 (4.4)	485 (4.9)
Netherlands	0 (0.0)	~ ~	2 (1.5)	~ ~	17 (4.3)	535 (20.4)	81 (4.5)	545 (9.2)
New Zealand	7 (2.1)	536 (18.4)	5 (1.6)	507 (12.6)	21 (3.4)	510 (9.3)	66 (4.0)	505 (6.0)
Norway	r 2 (1.3)	~ ~	1 (1.0)	~ ~	15 (3.8)	504 (6.2)	82 (3.8)	507 (2.8)
Portugal	1 (0.9)	~ ~	4 (1.3)	452 (10.4)	21 (3.4)	454 (5.9)	74 (3.8)	455 (2.8)
Romania	63 (4.2)	470 (5.1)	7 (2.3)	494 (12.2)	10 (2.5)	521 (10.0)	19 (3.1)	490 (10.5)
Russian Federation	9 (2.1)	512 (11.0)	6 (2.1)	556 (21.4)	18 (3.0)	533 (7.9)	67 (3.9)	536 (7.4)
Scotland	- -	- -	- -	- -	- -	- -	- -	- -
Singapore	1 (0.8)	~ ~	5 (1.9)	617 (23.0)	12 (2.7)	636 (14.1)	82 (3.2)	647 (5.4)
Slovak Republic	2 (1.1)	~ ~	6 (2.0)	547 (11.6)	10 (2.5)	547 (12.2)	82 (3.1)	546 (3.6)
Slovenia	r 35 (4.7)	539 (5.2)	13 (3.3)	542 (10.3)	17 (4.0)	534 (8.9)	35 (4.7)	543 (6.1)
Spain	r 40 (4.4)	487 (4.7)	4 (1.9)	490 (12.2)	11 (2.6)	479 (7.0)	45 (4.7)	489 (4.3)
Sweden	7 (2.2)	495 (17.2)	21 (3.0)	523 (6.5)	37 (4.0)	520 (5.0)	35 (3.9)	521 (5.6)
Switzerland	s 36 (4.6)	545 (10.7)	8 (2.6)	547 (13.1)	24 (4.0)	545 (13.4)	32 (3.5)	567 (7.9)
Thailand	r 72 (5.8)	532 (9.3)	15 (4.9)	525 (12.0)	9 (3.6)	501 (4.7)	4 (1.8)	523 (13.1)
United States	r 8 (2.3)	489 (17.7)	10 (2.0)	460 (8.4)	20 (3.4)	492 (7.6)	62 (4.2)	513 (5.8)

[1] Based on most frequent response for: checking answers, test and exams, routine computations, solving complex problems, and exploring number concepts.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.15

Teachers' Reports on Ways in Which Calculators Are Used at Least Once or Twice a Week - Mathematics - Upper Grade (Eighth Grade*)

Country	Percent of Students by Type of Use					
	Never or Hardly Ever Use Calculators	Checking Answers	Tests and Exams	Routine Computations	Solving Complex Problems	Exploring Number Concepts
Australia	r 6 (2.0)	r 84 (3.0)	r 47 (3.5)	r 92 (2.1)	r 76 (3.1)	r 48 (3.9)
Austria	r 2 (1.3)	r 91 (2.9)	r 64 (4.2)	r 91 (2.2)	r 70 (4.6)	s 28 (3.7)
Belgium (Fl)	39 (4.9)	24 (3.4)	10 (2.5)	28 (4.3)	15 (3.2)	10 (2.3)
Belgium (Fr)	s 18 (5.1)	s 53 (6.3)	s 16 (4.3)	s 41 (5.8)	s 39 (5.7)	s 24 (5.5)
Canada	5 (1.4)	85 (2.4)	r 52 (4.4)	82 (2.5)	86 (2.7)	r 63 (4.2)
Colombia	33 (4.6)	33 (4.4)	18 (3.8)	34 (4.7)	32 (4.4)	30 (4.9)
Cyprus	r 27 (4.6)	r 57 (5.3)	r 4 (2.3)	r 51 (5.8)	r 35 (4.3)	r 21 (4.6)
Czech Republic	3 (1.9)	80 (4.2)	22 (5.1)	67 (5.2)	80 (4.0)	16 (5.2)
Denmark	28 (4.9)	52 (4.9)	r 5 (2.0)	48 (5.1)	33 (4.4)	25 (4.2)
England	s 0 (0.0)	s 86 (2.4)	s 42 (3.4)	s 96 (1.0)	s 73 (2.6)	s 55 (3.4)
France	4 (2.0)	r 91 (2.8)	r 57 (4.8)	82 (3.5)	50 (5.0)	r 39 (5.3)
Germany	s 19 (3.8)	s 67 (4.8)	s 39 (4.9)	s 72 (4.4)	s 64 (5.4)	s 27 (5.5)
Greece	46 (4.1)	24 (3.5)	2 (1.0)	21 (3.5)	21 (3.4)	8 (2.4)
Hong Kong	8 (3.0)	74 (5.0)	53 (6.1)	79 (5.1)	62 (5.8)	29 (5.4)
Hungary	29 (3.8)	r 56 (5.1)	r 14 (2.9)	r 43 (4.4)	r 53 (4.7)	r 53 (4.4)
Iceland	r 0 (0.0)	r 91 (3.8)	r 51 (8.4)	r 97 (2.1)	r 99 (0.1)	r 69 (6.2)
Iran, Islamic Rep.	54 (5.9)	4 (1.6)	2 (1.7)	8 (2.4)	8 (2.8)	6 (1.6)
Ireland	68 (4.6)	18 (4.0)	4 (2.0)	r 17 (3.9)	r 7 (2.5)	r 4 (1.8)
Israel	r 11 (5.7)	r 75 (6.4)	r 57 (7.9)	r 72 (6.3)	r 56 (7.4)	r 43 (8.5)
Japan	79 (3.7)	1 (0.6)	0 (0.0)	3 (1.5)	2 (0.7)	3 (1.4)
Korea	76 (4.1)	1 (0.9)	1 (0.6)	6 (2.5)	4 (1.6)	1 (0.8)
Kuwait	23 (4.4)	51 (8.0)	25 (6.6)	52 (7.7)	48 (6.3)	22 (6.4)
Latvia (LSS)	r 13 (3.0)	r 50 (4.9)	r 8 (2.8)	r 59 (4.2)	r 49 (5.2)	r 17 (3.9)
Lithuania	r 12 (2.9)	r 72 (4.1)	r 9 (2.9)	r 66 (4.1)	r 58 (4.5)	r 18 (3.7)
Netherlands	0 (0.0)	83 (4.5)	50 (6.1)	97 (1.8)	67 (4.9)	46 (5.3)
New Zealand	7 (2.1)	41 (4.3)	20 (3.1)	85 (3.0)	70 (4.0)	54 (4.5)
Norway	r 2 (1.3)	r 93 (2.4)	r 24 (4.0)	r 91 (2.8)	r 72 (4.7)	r 35 (4.8)
Portugal	1 (0.9)	86 (2.6)	31 (3.5)	76 (3.4)	67 (3.7)	55 (4.2)
Romania	63 (4.2)	20 (3.4)	1 (1.1)	25 (3.3)	11 (2.7)	9 (2.3)
Russian Federation	9 (2.1)	73 (4.5)	15 (2.8)	76 (3.9)	45 (5.2)	6 (1.7)
Scotland	- -	- -	- -	- -	- -	- -
Singapore	1 (0.8)	89 (2.7)	47 (4.7)	83 (3.4)	82 (3.7)	57 (4.4)
Slovak Republic	2 (1.1)	79 (3.7)	31 (4.1)	72 (4.6)	77 (3.8)	60 (4.3)
Slovenia	r 35 (4.7)	r 39 (5.2)	r 4 (2.1)	r 38 (5.3)	r 28 (4.6)	r 6 (2.5)
Spain	r 40 (4.4)	r 46 (4.6)	r 16 (3.4)	r 35 (4.4)	r 39 (4.8)	r 29 (4.2)
Sweden	7 (2.2)	r 42 (4.1)	r 13 (2.8)	r 57 (4.1)	r 60 (3.6)	r 25 (3.5)
Switzerland	s 36 (4.6)	s 47 (4.9)	s 16 (2.7)	s 48 (4.3)	s 35 (3.9)	s 17 (2.8)
Thailand	r 72 (5.8)	r 7 (3.0)	r 0 (0.0)	r 5 (2.4)	r 9 (3.1)	s 10 (3.6)
United States	r 8 (2.3)	r 71 (3.8)	r 47 (4.2)	r 68 (3.6)	r 76 (3.4)	r 58 (3.9)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.16

Students' Reports on Frequency of Using Calculators in Mathematics Class Upper Grade (Eighth Grade*)

Country	Never		Once in a While		Pretty Often		Almost Always	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	4 (1.1)	495 (28.4)	10 (0.9)	509 (7.5)	31 (1.1)	533 (4.4)	55 (1.9)	539 (4.6)
Austria	2 (0.7)	~ ~	7 (0.8)	515 (9.9)	17 (1.2)	542 (7.2)	74 (2.1)	542 (3.3)
Belgium (Fl)	34 (4.1)	571 (12.4)	36 (2.4)	577 (6.1)	20 (2.5)	556 (10.5)	10 (1.6)	530 (11.7)
Belgium (Fr)	37 (2.7)	526 (4.6)	41 (1.9)	543 (3.9)	14 (1.6)	516 (8.4)	9 (1.1)	491 (8.6)
Canada	6 (1.2)	493 (8.7)	22 (1.6)	523 (3.6)	33 (1.2)	532 (3.0)	38 (2.2)	534 (4.4)
Colombia	54 (2.5)	394 (3.2)	26 (1.3)	382 (4.4)	9 (0.9)	393 (6.9)	11 (1.1)	371 (4.1)
Cyprus	30 (2.0)	480 (3.5)	39 (1.4)	477 (3.1)	21 (1.0)	475 (4.2)	10 (0.9)	452 (4.5)
Czech Republic	5 (1.2)	552 (12.0)	33 (2.5)	553 (6.1)	37 (2.1)	578 (6.8)	24 (1.9)	560 (5.5)
Denmark	32 (3.7)	506 (4.0)	37 (2.6)	499 (4.2)	19 (1.7)	514 (6.3)	12 (1.7)	498 (5.0)
England	0 (0.1)	~ ~	9 (0.9)	467 (6.6)	46 (1.6)	507 (4.3)	45 (1.8)	517 (3.3)
France	2 (0.9)	~ ~	27 (1.5)	539 (4.0)	40 (1.3)	548 (3.4)	30 (1.4)	530 (5.1)
Germany	25 (2.8)	502 (7.1)	19 (1.7)	527 (9.1)	20 (1.5)	517 (7.6)	35 (2.0)	504 (6.2)
Greece	51 (2.6)	482 (3.9)	26 (1.3)	494 (4.0)	14 (1.1)	489 (5.6)	9 (1.0)	473 (6.0)
Hong Kong	8 (2.3)	572 (27.9)	9 (1.2)	567 (15.8)	33 (1.9)	593 (6.4)	49 (2.5)	595 (7.0)
Hungary	20 (2.2)	521 (6.2)	39 (1.9)	539 (4.0)	24 (1.3)	547 (5.9)	17 (1.3)	547 (5.7)
Iceland	1 (0.3)	~ ~	6 (0.9)	474 (10.9)	32 (2.0)	491 (5.5)	61 (2.3)	487 (4.8)
Iran, Islamic Rep.	79 (1.4)	432 (2.4)	13 (1.0)	435 (4.7)	4 (0.5)	415 (4.4)	4 (0.5)	400 (6.5)
Ireland	79 (1.7)	535 (5.3)	14 (1.0)	517 (7.0)	4 (0.6)	493 (9.4)	3 (0.5)	484 (11.7)
Israel	7 (1.8)	517 (12.5)	21 (2.2)	536 (7.6)	27 (1.6)	532 (8.6)	45 (3.4)	515 (6.2)
Japan	75 (2.3)	607 (2.1)	21 (1.9)	603 (3.4)	3 (0.7)	575 (7.0)	0 (0.1)	~ ~
Korea	93 (0.5)	613 (2.5)	5 (0.4)	570 (9.7)	1 (0.3)	~ ~	1 (0.2)	~ ~
Kuwait	27 (3.2)	394 (3.7)	35 (2.1)	395 (3.1)	23 (1.5)	391 (3.8)	14 (1.7)	387 (3.3)
Latvia (LSS)	14 (1.4)	502 (5.7)	27 (1.4)	499 (4.1)	35 (1.3)	492 (4.1)	24 (2.0)	487 (5.2)
Lithuania	17 (1.7)	476 (6.5)	34 (1.5)	472 (3.9)	24 (1.2)	484 (4.5)	25 (1.7)	482 (5.8)
Netherlands	1 (0.2)	~ ~	9 (1.3)	514 (16.9)	36 (1.7)	547 (7.2)	54 (2.1)	544 (7.4)
New Zealand	6 (1.1)	519 (13.3)	20 (1.7)	503 (6.9)	37 (1.3)	511 (5.3)	36 (2.0)	510 (6.1)
Norway	4 (1.0)	465 (9.6)	25 (1.7)	497 (3.3)	39 (1.2)	509 (3.1)	33 (1.9)	508 (3.1)
Portugal	3 (0.6)	455 (7.3)	27 (1.6)	457 (3.1)	34 (1.2)	454 (3.5)	35 (1.5)	454 (2.8)
Romania	57 (1.7)	484 (4.7)	25 (1.2)	490 (5.4)	9 (0.6)	475 (6.8)	9 (0.8)	465 (7.3)
Russian Federation	9 (1.4)	538 (11.3)	37 (2.3)	537 (7.2)	25 (1.6)	537 (5.3)	29 (1.6)	534 (5.7)
Scotland	2 (0.7)	~ ~	16 (1.5)	498 (7.0)	48 (1.5)	501 (5.3)	34 (2.0)	498 (8.8)
Singapore	1 (0.4)	~ ~	16 (1.5)	613 (6.0)	54 (1.2)	648 (5.0)	29 (1.7)	655 (5.6)
Slovak Republic	4 (0.7)	550 (13.7)	24 (1.7)	543 (4.9)	37 (1.3)	554 (4.3)	35 (1.7)	544 (4.5)
Slovenia	44 (3.0)	544 (4.1)	38 (2.2)	540 (4.2)	10 (1.0)	534 (7.9)	8 (0.8)	535 (8.5)
Spain	49 (3.3)	493 (2.9)	23 (1.9)	492 (3.4)	12 (1.1)	479 (5.3)	17 (2.0)	471 (4.3)
Sweden	4 (0.9)	482 (13.1)	42 (2.2)	520 (3.2)	36 (1.7)	527 (3.9)	18 (2.2)	511 (5.2)
Switzerland	45 (2.9)	538 (4.6)	22 (1.6)	552 (5.1)	16 (1.2)	553 (5.5)	16 (1.3)	561 (6.3)
Thailand	59 (2.2)	514 (4.7)	34 (1.7)	535 (8.0)	5 (0.8)	543 (16.3)	2 (0.3)	~ ~
United States	10 (1.6)	464 (9.4)	20 (1.6)	498 (5.8)	26 (1.2)	501 (5.3)	44 (2.7)	511 (5.6)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.17

Teachers' Reports on Frequency of Using Computers in Mathematics Class to Solve Exercises or Problems - Upper Grade (Eighth Grade*)

Country		Never or Almost Never		Some Lessons		Most or Every Lesson	
		Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	r	78 (3.2)	531 (5.3)	21 (3.2)	535 (9.6)	0 (0.2)	~ ~
Austria	r	69 (4.5)	551 (5.6)	29 (4.4)	543 (7.3)	1 (0.5)	~ ~
Belgium (Fl)		99 (0.7)	574 (4.6)	1 (0.7)	~ ~	0 (0.0)	~ ~
Belgium (Fr)	s	95 (2.4)	543 (4.4)	4 (2.2)	555 (25.7)	1 (1.0)	~ ~
Canada		82 (3.5)	533 (2.9)	18 (3.5)	511 (10.3)	1 (0.5)	~ ~
Colombia		94 (2.2)	387 (3.8)	5 (2.0)	391 (12.9)	1 (0.9)	~ ~
Cyprus	r	89 (3.3)	468 (2.9)	11 (3.3)	476 (11.4)	0 (0.0)	~ ~
Czech Republic		74 (5.4)	560 (6.4)	23 (5.1)	568 (8.8)	4 (2.8)	549 (0.7)
Denmark		38 (4.5)	500 (4.5)	62 (4.5)	507 (2.9)	0 (0.0)	~ ~
England	s	53 (3.9)	517 (5.9)	46 (3.7)	514 (6.9)	2 (1.0)	~ ~
France		86 (3.2)	541 (3.3)	14 (3.2)	536 (11.5)	0 (0.0)	~ ~
Germany	s	87 (3.1)	510 (5.8)	13 (3.1)	550 (12.3)	0 (0.0)	~ ~
Greece		85 (2.9)	481 (3.3)	12 (2.5)	500 (7.7)	2 (1.4)	~ ~
Hong Kong		90 (3.5)	590 (7.3)	9 (3.7)	576 (29.4)	1 (1.2)	~ ~
Hungary		- -	- -	- -	- -	- -	- -
Iceland		- -	- -	- -	- -	- -	- -
Iran, Islamic Rep.		93 (5.5)	430 (2.3)	6 (5.5)	435 (18.2)	1 (1.0)	~ ~
Ireland		99 (0.9)	528 (6.0)	1 (0.9)	~ ~	0 (0.0)	~ ~
Israel		- -	- -	- -	- -	- -	- -
Japan		90 (2.7)	604 (2.5)	9 (2.6)	612 (10.1)	1 (0.5)	~ ~
Korea		96 (1.6)	610 (2.5)	3 (1.3)	618 (21.6)	1 (1.0)	~ ~
Kuwait		73 (7.1)	393 (2.9)	21 (6.6)	387 (3.4)	6 (3.4)	389 (10.6)
Latvia (LSS)	r	97 (1.6)	490 (3.3)	3 (1.6)	494 (14.9)	0 (0.0)	~ ~
Lithuania		94 (1.8)	480 (4.1)	6 (1.8)	450 (12.3)	0 (0.0)	~ ~
Netherlands		- -	- -	- -	- -	- -	- -
New Zealand		86 (3.1)	506 (4.4)	14 (3.1)	526 (15.7)	0 (0.0)	~ ~
Norway	r	90 (2.6)	507 (2.7)	10 (2.6)	509 (5.1)	0 (0.0)	~ ~
Portugal		97 (1.5)	454 (2.6)	3 (1.5)	482 (23.2)	0 (0.0)	~ ~
Romania		96 (1.7)	481 (4.4)	4 (1.7)	512 (20.6)	0 (0.0)	~ ~
Russian Federation		78 (2.6)	533 (6.8)	15 (2.2)	537 (6.9)	6 (2.4)	566 (14.6)
Scotland		- -	- -	- -	- -	- -	- -
Singapore		92 (2.7)	643 (5.3)	8 (2.7)	652 (15.3)	0 (0.0)	~ ~
Slovak Republic		95 (1.5)	543 (3.3)	4 (1.3)	592 (13.5)	1 (0.8)	~ ~
Slovenia	r	69 (4.5)	539 (4.5)	27 (4.5)	545 (7.2)	4 (2.1)	527 (21.9)
Spain	r	89 (3.1)	488 (2.6)	11 (3.1)	472 (9.1)	0 (0.0)	~ ~
Sweden	r	74 (2.9)	519 (4.1)	25 (2.9)	515 (7.3)	0 (0.3)	~ ~
Switzerland	s	87 (3.2)	549 (5.6)	13 (3.3)	577 (13.0)	1 (0.8)	~ ~
Thailand	r	97 (2.0)	528 (7.5)	1 (1.5)	~ ~	2 (1.3)	~ ~
United States	r	76 (3.1)	502 (5.9)	21 (3.2)	497 (9.1)	3 (1.7)	506 (22.2)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available. A tilde (~) indicates insufficient data to report achievement.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.18

Students' Reports on Frequency of Using Computers in Mathematics Class Upper Grade (Eighth Grade*)

Country	Never		Once in a While		Always or Pretty Often	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	77 (2.1)	536 (4.4)	18 (1.7)	536 (7.6)	5 (0.9)	477 (11.4)
Austria	62 (2.6)	545 (3.8)	32 (2.2)	540 (5.4)	6 (0.8)	487 (7.9)
Belgium (Fl)	94 (1.1)	568 (5.7)	4 (0.9)	544 (15.7)	2 (0.6)	~ ~
Belgium (Fr)	94 (1.4)	532 (3.3)	3 (0.7)	531 (22.2)	4 (0.9)	437 (20.4)
Canada	82 (1.4)	532 (2.4)	13 (1.3)	528 (8.4)	5 (0.4)	476 (6.7)
Colombia	95 (0.5)	389 (2.9)	3 (0.4)	390 (6.9)	3 (0.3)	370 (5.9)
Cyprus	73 (0.9)	485 (1.8)	16 (0.9)	459 (4.9)	11 (0.8)	432 (4.3)
Czech Republic	88 (2.9)	564 (5.1)	8 (1.9)	560 (12.5)	4 (1.8)	570 (18.0)
Denmark	40 (3.6)	505 (4.0)	51 (3.0)	507 (3.6)	9 (1.3)	486 (8.4)
England	45 (2.6)	512 (4.9)	46 (2.3)	514 (4.3)	9 (1.2)	457 (6.8)
France	88 (2.4)	542 (3.3)	8 (2.0)	531 (10.8)	4 (0.8)	492 (9.6)
Germany	84 (2.1)	511 (4.6)	11 (1.9)	533 (9.3)	5 (0.7)	455 (7.7)
Greece	83 (1.0)	490 (2.9)	10 (0.7)	471 (6.4)	7 (0.6)	443 (6.2)
Hong Kong	91 (0.7)	592 (6.2)	6 (0.5)	580 (11.4)	3 (0.4)	559 (16.7)
Hungary	92 (0.8)	539 (3.2)	5 (0.8)	548 (12.3)	2 (0.4)	~ ~
Iceland	81 (2.4)	494 (4.4)	11 (1.3)	479 (5.1)	8 (1.6)	442 (9.8)
Iran, Islamic Rep.	92 (0.8)	432 (2.3)	3 (0.4)	416 (5.2)	4 (0.5)	399 (5.6)
Ireland	96 (1.1)	531 (5.0)	3 (0.9)	498 (30.4)	1 (0.3)	~ ~
Israel	76 (4.5)	530 (6.9)	12 (2.6)	523 (11.5)	11 (3.0)	489 (15.7)
Japan	77 (3.3)	604 (2.9)	19 (2.6)	611 (4.6)	4 (1.2)	604 (14.5)
Korea	93 (0.7)	611 (2.4)	5 (0.5)	587 (9.4)	2 (0.3)	~ ~
Kuwait	78 (2.0)	398 (2.5)	8 (0.9)	380 (7.6)	14 (1.7)	371 (2.8)
Latvia (LSS)	91 (1.1)	497 (3.1)	6 (0.9)	484 (8.5)	3 (0.4)	458 (12.9)
Lithuania	92 (1.0)	481 (3.4)	5 (0.8)	456 (8.8)	3 (0.5)	456 (13.2)
Netherlands	81 (3.4)	536 (7.8)	18 (3.3)	575 (13.8)	2 (0.4)	~ ~
New Zealand	79 (2.5)	512 (4.5)	17 (2.1)	514 (8.7)	4 (0.6)	442 (9.1)
Norway	88 (1.5)	508 (2.4)	10 (1.5)	487 (6.1)	2 (0.3)	~ ~
Portugal	97 (0.6)	455 (2.5)	2 (0.6)	~ ~	1 (0.2)	~ ~
Romania	78 (1.2)	487 (4.5)	8 (0.7)	471 (8.7)	14 (0.9)	468 (8.8)
Russian Federation	94 (0.8)	538 (5.7)	4 (0.6)	528 (6.8)	2 (0.3)	~ ~
Scotland	54 (3.1)	504 (6.9)	37 (2.5)	503 (6.1)	9 (1.3)	459 (4.7)
Singapore	90 (1.5)	644 (5.2)	8 (1.4)	653 (8.2)	2 (0.4)	~ ~
Slovak Republic	94 (1.0)	549 (3.5)	5 (1.0)	539 (9.6)	1 (0.2)	~ ~
Slovenia	89 (0.7)	547 (3.1)	7 (0.6)	494 (7.0)	3 (0.4)	492 (10.1)
Spain	93 (1.3)	490 (2.0)	4 (0.8)	466 (7.5)	3 (0.7)	452 (12.4)
Sweden	61 (3.2)	527 (3.5)	30 (2.7)	521 (3.8)	9 (1.1)	467 (5.6)
Switzerland	82 (2.1)	549 (3.2)	14 (1.8)	546 (6.0)	4 (0.6)	512 (16.9)
Thailand	91 (1.0)	522 (5.8)	6 (0.6)	535 (10.3)	3 (0.5)	510 (9.2)
United States	69 (2.5)	504 (4.6)	21 (1.8)	514 (6.8)	10 (1.5)	458 (7.5)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A tilde (~) indicates insufficient data to report achievement.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

HOW MUCH HOMEWORK ARE STUDENTS ASSIGNED?

Although teachers often give students time to begin or review homework assignments in class, homework is generally considered a method of extending the time spent on regular classroom lessons. Table 5.19 presents teachers' reports about how often they assigned homework and the typical lengths of such assignments. Internationally, most eighth-grade students are assigned homework at least three times a week. Most typically, for the majority of students the assignments were 30 minutes or less in length. Homework assignments were more than 30 minutes for the majority of students in Cyprus, Greece, Romania, the Russian Federation, Singapore, and Thailand. The majority of students were assigned mathematics homework less frequently than three times a week in Belgium (Flemish), the Czech Republic, England, Iran, Japan, Korea, Scotland, and Sweden, although teachers in England and Iran gave longer assignments for about half of their students.

Homework generally has its biggest impact when it is commented on and graded by teachers. Table 5.20 presents teachers' reports about their use of students' written mathematics homework. In most countries, for at least 70% of the students, teachers reported at least sometimes, if not always, correcting homework assignments and returning those assignments to students. The exceptions were France, Germany, Hungary, Iceland, Japan, the Netherlands, Portugal, the Slovak Republic, and Slovenia.

Many teachers do not count mathematics homework directly in determining grades, but use it more as a method to monitor students' understanding and to correct misconceptions. In general, for the TIMSS countries, teachers reported that mathematics homework assignments contributed only sometimes to students' grades or marks. In some countries, however, it had even less impact on grades. According to their teachers, homework never or only rarely contributed to the grades for the majority of the students in Austria, Belgium (Flemish), the Czech Republic, Denmark, France, Germany, Hungary, Ireland, Japan, Korea, Latvia (LSS), Lithuania, the Netherlands, Norway, Singapore, the Slovak Republic, Slovenia, Sweden, and Switzerland. At the other end of the continuum, teachers reported that homework always contributed to the grades for the majority of the students in Cyprus, England, Portugal, the Russian Federation, and the United States.

Table 5.19

Teachers' Reports About the Amount of Mathematics Homework Assigned Upper Grade (Eighth Grade*)

Country	Percent of Students Taught by Teachers						
	Never Assigning Homework	Assigning Homework Less Than Once a Week		Assigning Homework Once or Twice a Week		Assigning Homework Three Times a Week or More Often	
		30 Minutes or Less	More Than 30 Minutes	30 Minutes or Less	More Than 30 Minutes	30 Minutes or Less	More Than 30 Minutes
Australia	r 1 (0.8)	6 (1.6)	0 (0.2)	21 (2.6)	4 (1.9)	62 (3.4)	5 (1.7)
Austria	r 0 (0.0)	1 (0.5)	0 (0.0)	24 (4.4)	3 (1.4)	63 (5.0)	10 (2.1)
Belgium (Fl)	0 (0.0)	17 (3.5)	2 (1.1)	52 (4.8)	10 (2.6)	15 (2.9)	5 (2.1)
Belgium (Fr)	1 (1.2)	2 (1.4)	0 (0.0)	30 (5.1)	5 (2.2)	55 (5.5)	7 (2.8)
Canada	r 2 (1.1)	2 (0.9)	1 (0.7)	22 (3.4)	2 (0.9)	59 (3.7)	13 (2.7)
Colombia	0 (0.0)	1 (0.9)	1 (0.8)	17 (4.7)	13 (2.9)	29 (4.2)	39 (4.2)
Cyprus	r 0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	50 (5.3)	50 (5.3)
Czech Republic	0 (0.4)	14 (4.5)	0 (0.0)	62 (5.2)	0 (0.3)	23 (3.5)	1 (0.6)
Denmark	0 (0.0)	4 (1.8)	0 (0.0)	42 (4.7)	3 (1.6)	49 (5.2)	2 (1.0)
England	0 (0.0)	3 (1.0)	1 (0.6)	44 (3.8)	47 (3.7)	3 (1.4)	2 (1.1)
France	0 (0.0)	0 (0.0)	2 (0.9)	7 (2.5)	4 (1.2)	77 (3.9)	10 (2.8)
Germany	1 (1.4)	1 (1.4)	0 (0.0)	22 (4.4)	0 (0.0)	73 (5.0)	3 (1.8)
Greece	0 (0.0)	1 (0.9)	0 (0.0)	0 (0.0)	0 (0.2)	31 (3.4)	67 (3.5)
Hong Kong	1 (1.4)	4 (2.2)	3 (1.8)	25 (4.7)	15 (4.1)	38 (6.0)	14 (4.1)
Hungary	0 (0.0)	1 (0.7)	0 (0.0)	2 (1.3)	0 (0.0)	82 (3.0)	15 (3.1)
Iceland	0 (0.0)	0 (0.0)	0 (0.0)	5 (2.0)	1 (1.0)	75 (5.5)	19 (5.5)
Iran, Islamic Rep.	0 (0.0)	1 (0.5)	3 (1.4)	10 (3.0)	59 (4.4)	2 (1.1)	26 (4.3)
Ireland	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.9)	0 (0.0)	94 (2.2)	5 (2.0)
Israel	r 0 (0.0)	1 (1.2)	0 (0.0)	3 (2.2)	0 (0.0)	48 (7.1)	48 (6.8)
Japan	0 (0.0)	27 (4.0)	4 (1.7)	37 (3.7)	10 (2.3)	16 (2.9)	6 (1.5)
Korea	0 (0.0)	5 (1.6)	8 (2.2)	27 (3.7)	21 (3.3)	21 (3.2)	18 (3.4)
Kuwait	0 (0.0)	0 (0.0)	0 (0.0)	19 (6.1)	2 (2.0)	60 (8.3)	18 (6.0)
Latvia (LSS)	0 (0.0)	0 (0.0)	0 (0.0)	8 (2.8)	1 (0.9)	83 (3.9)	9 (2.4)
Lithuania	0 (0.0)	0 (0.0)	0 (0.0)	2 (1.3)	0 (0.0)	76 (3.9)	22 (3.9)
Netherlands	1 (1.2)	1 (0.9)	0 (0.0)	12 (3.5)	2 (1.4)	81 (4.2)	4 (2.2)
New Zealand	0 (0.0)	5 (1.9)	2 (0.1)	34 (4.3)	4 (1.5)	54 (4.2)	2 (1.2)
Norway	r 0 (0.0)	0 (0.0)	0 (0.0)	7 (2.7)	8 (2.7)	67 (4.3)	18 (4.0)
Portugal	0 (0.0)	1 (0.9)	1 (0.5)	30 (4.0)	2 (1.1)	57 (4.1)	9 (2.4)
Romania	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.8)	1 (0.6)	11 (2.8)	87 (2.8)
Russian Federation	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.9)	1 (0.8)	42 (3.5)	55 (3.4)
Scotland	r 0 (0.4)	20 (4.3)	4 (2.0)	46 (5.1)	6 (2.3)	24 (4.1)	0 (0.0)
Singapore	0 (0.0)	1 (0.9)	0 (0.0)	3 (1.5)	11 (3.1)	26 (4.1)	58 (4.5)
Slovak Republic	0 (0.0)	1 (0.9)	0 (0.0)	12 (2.8)	1 (0.7)	83 (3.4)	4 (1.7)
Slovenia	r 0 (0.0)	0 (0.0)	0 (0.0)	2 (1.4)	0 (0.0)	74 (4.4)	24 (4.2)
Spain	r 0 (0.0)	4 (1.6)	0 (0.0)	18 (3.3)	9 (2.7)	47 (4.4)	22 (3.7)
Sweden	r 0 (0.4)	19 (3.0)	7 (1.9)	45 (4.0)	26 (3.3)	2 (1.2)	1 (1.2)
Switzerland	0 (0.0)	1 (0.4)	1 (0.3)	26 (4.2)	4 (1.5)	61 (4.4)	6 (2.3)
Thailand	r 0 (0.0)	0 (0.0)	0 (0.0)	6 (3.5)	20 (4.8)	16 (4.7)	58 (6.6)
United States	r 0 (0.1)	3 (1.3)	0 (0.0)	7 (1.8)	3 (0.9)	64 (2.9)	23 (3.1)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

An "r" indicates teacher response data available for 70-84% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.20

Teachers' Reports on Their Use of Students' Written Mathematics Homework[1] Upper Grade (Eighth Grade*)

Country	Percent of Students Taught by Teachers							
	Collecting, Correcting, and then Returning Assignments to Students				Using Homework to Contribute Towards Students' Grades or Marks			
	Never	Rarely	Sometimes	Always	Never	Rarely	Sometimes	Always
Australia	r 7 (1.9)	14 (2.5)	41 (3.7)	38 (3.6)	r 23 (3.1)	17 (2.6)	41 (3.4)	20 (2.8)
Austria	r 1 (0.5)	25 (3.4)	22 (3.2)	53 (3.8)	r 22 (3.8)	34 (4.0)	27 (3.4)	17 (3.6)
Belgium (Fl)	5 (1.6)	5 (2.9)	9 (2.3)	80 (3.7)	34 (4.9)	16 (3.0)	21 (3.9)	29 (3.9)
Belgium (Fr)	s 7 (3.2)	7 (2.9)	28 (5.2)	58 (6.0)	s 21 (4.6)	20 (4.0)	25 (4.9)	33 (5.7)
Canada	r 4 (1.6)	21 (2.9)	50 (4.2)	25 (3.3)	r 12 (2.7)	10 (2.7)	49 (4.3)	29 (3.4)
Colombia	0 (0.0)	9 (2.2)	11 (2.9)	80 (3.7)	1 (1.0)	10 (2.2)	49 (5.1)	40 (4.8)
Cyprus	r 8 (2.9)	18 (3.4)	56 (5.0)	17 (4.4)	r 0 (0.0)	2 (0.6)	37 (4.7)	62 (4.7)
Czech Republic	4 (2.8)	2 (1.3)	24 (3.9)	70 (4.7)	42 (4.9)	35 (5.2)	19 (4.5)	3 (1.5)
Denmark	10 (3.8)	17 (3.7)	45 (5.0)	27 (4.8)	44 (5.0)	29 (4.4)	17 (3.7)	10 (2.9)
England	s 2 (1.1)	3 (1.0)	42 (3.6)	53 (3.9)	s 4 (1.5)	7 (1.5)	39 (3.2)	50 (3.4)
France	11 (2.8)	43 (4.6)	26 (4.0)	19 (3.7)	44 (4.4)	33 (4.5)	14 (2.7)	9 (2.9)
Germany	s 13 (4.0)	34 (5.1)	47 (6.0)	7 (2.0)	s 32 (5.1)	33 (5.0)	28 (4.4)	6 (2.9)
Greece	9 (2.4)	20 (3.2)	49 (3.9)	22 (3.6)	3 (1.4)	7 (1.8)	43 (3.6)	46 (3.9)
Hong Kong	0 (0.0)	1 (1.1)	12 (3.5)	87 (3.6)	23 (4.4)	25 (4.9)	19 (4.3)	33 (5.3)
Hungary	9 (2.5)	35 (4.2)	49 (4.5)	7 (2.3)	20 (3.7)	40 (4.2)	28 (3.7)	11 (2.8)
Iceland	r 8 (3.7)	25 (7.1)	62 (7.5)	6 (1.8)	r 9 (3.9)	16 (4.3)	40 (6.4)	35 (7.6)
Iran, Islamic Rep.	10 (2.9)	14 (3.1)	40 (4.7)	37 (4.8)	11 (2.3)	27 (5.9)	41 (5.2)	21 (4.4)
Ireland	6 (2.4)	16 (3.8)	57 (5.1)	20 (4.2)	35 (5.2)	20 (4.1)	37 (4.5)	7 (2.4)
Israel	r 0 (0.0)	17 (5.2)	59 (8.1)	24 (8.3)	r 0 (0.0)	11 (5.3)	59 (8.4)	30 (8.5)
Japan	21 (3.4)	34 (4.3)	25 (3.9)	21 (3.6)	32 (3.6)	37 (4.5)	18 (4.0)	13 (3.1)
Korea	1 (1.0)	10 (2.4)	61 (3.9)	28 (3.7)	26 (3.2)	34 (4.0)	35 (4.0)	6 (1.7)
Kuwait	1 (0.8)	3 (2.6)	28 (6.9)	68 (6.6)	9 (3.9)	11 (4.6)	38 (8.0)	42 (7.6)
Latvia (LSS)	r 2 (1.6)	11 (3.0)	30 (4.1)	57 (4.7)	r 32 (4.0)	23 (3.4)	25 (3.4)	20 (3.6)
Lithuania	5 (1.7)	9 (2.6)	52 (4.4)	35 (4.5)	r 48 (5.0)	9 (2.7)	28 (4.2)	15 (3.2)
Netherlands	49 (5.2)	29 (5.0)	22 (3.9)	1 (0.8)	67 (5.2)	17 (4.6)	12 (3.8)	4 (1.9)
New Zealand	3 (1.7)	20 (3.1)	48 (4.2)	28 (3.7)	15 (2.9)	28 (3.8)	41 (4.3)	16 (3.2)
Norway	r 7 (2.4)	17 (3.6)	64 (4.6)	13 (3.5)	r 16 (3.5)	48 (5.0)	29 (4.6)	7 (2.6)
Portugal	9 (2.5)	23 (4.0)	43 (4.0)	26 (4.0)	2 (1.2)	13 (3.1)	34 (4.3)	51 (4.4)
Romania	4 (1.9)	11 (2.5)	49 (4.0)	37 (4.2)	8 (2.4)	16 (2.9)	44 (4.3)	32 (3.5)
Russian Federation	0 (0.1)	2 (1.1)	23 (3.7)	75 (4.0)	2 (0.9)	3 (1.3)	38 (5.5)	57 (5.1)
Scotland	- -	- -	- -	- -	- -	- -	- -	- -
Singapore	0 (0.0)	0 (0.0)	6 (2.2)	94 (2.2)	33 (4.6)	26 (4.2)	32 (4.0)	9 (2.5)
Slovak Republic	6 (2.6)	30 (3.8)	57 (4.7)	7 (2.2)	51 (4.7)	30 (4.3)	18 (3.0)	1 (0.6)
Slovenia	r 4 (2.0)	28 (4.9)	60 (5.1)	8 (2.8)	r 39 (4.1)	40 (5.0)	19 (4.2)	2 (1.6)
Spain	r 9 (2.9)	4 (1.8)	26 (4.6)	61 (4.8)	r 3 (1.6)	7 (2.5)	41 (4.8)	49 (4.8)
Sweden	r 6 (2.0)	8 (2.0)	24 (3.1)	62 (3.9)	r 27 (3.7)	23 (3.2)	32 (3.5)	18 (2.8)
Switzerland	s 5 (1.8)	23 (3.8)	56 (4.6)	16 (2.9)	s 42 (4.5)	42 (4.7)	15 (3.4)	0 (0.2)
Thailand	s 0 (0.0)	1 (0.6)	19 (4.9)	80 (4.9)	s 16 (4.8)	11 (3.1)	57 (5.8)	16 (4.7)
United States	r 5 (1.4)	15 (2.3)	42 (4.2)	38 (4.4)	r 1 (0.4)	4 (1.6)	27 (4.3)	68 (4.3)

[1] Based on those teachers who assign homework.

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

WHAT ASSESSMENT AND EVALUATION PROCEDURES DO TEACHERS USE?

Teachers in participating countries were asked about the importance they place on different types of assessment and how they use assessment information. Their responses to these two questions are presented in Tables 5.21 and 5.22, respectively. The weight given to each type of assessment varied greatly from country to country. Internationally, the least weight reportedly was given to external standardized tests and teacher-made objective tests. Across all participating countries, fewer than 80% of the eighth-grade students had mathematics teachers who reported giving quite a lot or a great deal of weight to these types of assessments.

The Hungarian teachers reported the heaviest emphasis on projects or practical exercises. They reported relying on this type of assessment for 90% of the students, with the next highest countries being Colombia with 77%, Denmark with 74%, and Israel with 70%. However, the most heavily weighted types of assessment were teacher-made tests requiring explanations, observations of students, and students' responses in class. One or more of these assessment types was weighted heavily for 80% or more of the eighth-grade students in many European and Eastern European countries. In contrast, teachers were in less agreement about assessment approaches within Australia, Canada, England, Hong Kong, Israel, Japan, Korea, New Zealand, Singapore, Slovenia, Switzerland, Thailand, and the United States, where no type of assessment was weighted heavily for as many as 80% of the students.

As might be anticipated, mathematics teachers in most countries reported using assessment information to provide grades or marks, to provide student feedback, to diagnose learning problems, and to plan future lessons. Teachers in fewer countries reported considerable use of assessment information to report to parents or for the purpose of tracking or making program assignments.

As reported in Table 5.23, eighth-grade students reported substantial variation in the frequency of testing in mathematics classes. The majority of the students reported having quizzes and tests only once in a while or never in Austria, the Czech Republic, Denmark, England, Germany, Hungary, Iceland, Ireland, Japan, Korea, Latvia (LSS), Norway, Scotland, and the Slovak Republic. In contrast, one-third or more of the students reported almost always having quizzes or tests in Colombia, Hong Kong, Kuwait, Romania, Spain, and the United States. In a number of countries, there was a tendency for the reports of the most frequent testing to be associated with lower-achieving students. One could argue that these students can least afford time diverted from their ongoing instructional program. However, teachers may provide shorter lessons and follow-up quizzes for lower-achieving students to more closely monitor their grasp of the subject matter.

Table 5.21

Teachers' Reports on the Types of Assessment Given "Quite A Lot" or "A Great Deal" of Weight in Assessing Students' Work in Mathematics Class
Upper Grade (Eighth Grade*)

Country	Percent of Students Taught by Teachers Relying on Different Types of Assessment						
	External Standardized Tests	Teacher-Made Tests Requiring Explanations	Teacher-Made Objective Tests	Homework Assignments	Projects or Practical Exercises	Observations of Students	Students' Responses in Class
Australia	r 8 (1.8)	r 42 (2.9)	r 24 (2.9)	r 26 (2.9)	r 29 (2.9)	r 37 (3.4)	r 34 (3.3)
Austria	r 4 (1.1)	r 29 (3.1)	r 1 (0.5)	r 47 (3.7)	s 23 (3.8)	r 97 (1.6)	r 81 (4.0)
Belgium (Fl)	10 (2.6)	94 (1.9)	11 (3.1)	15 (2.7)	16 (2.6)	50 (4.0)	55 (4.0)
Belgium (Fr)	s 6 (2.5)	s 85 (4.8)	s 16 (4.4)	s 35 (6.0)	s 6 (3.6)	s 47 (6.3)	s 58 (5.5)
Canada	r 16 (3.3)	r 49 (4.0)	r 18 (3.0)	r 44 (4.5)	r 32 (3.6)	r 43 (4.5)	r 41 (3.9)
Colombia	16 (3.7)	81 (4.0)	55 (4.7)	90 (2.5)	77 (3.9)	88 (3.2)	94 (2.0)
Cyprus	r 40 (3.7)	r 71 (4.9)	r 56 (4.7)	r 96 (2.0)	r 67 (4.7)	r 88 (3.1)	r 100 (0.0)
Czech Republic	r 43 (5.4)	100 (0.3)	r 19 (5.1)	14 (3.1)	r 29 (4.9)	74 (4.4)	96 (2.6)
Denmark	54 (5.2)	75 (4.8)	21 (4.0)	66 (5.2)	74 (4.2)	97 (1.8)	91 (2.9)
England	s 36 (3.2)	s 32 (3.0)	s 7 (1.8)	s 68 (3.3)	s 48 (3.5)	s 71 (2.9)	s 66 (3.4)
France	23 (3.7)	83 (3.7)	25 (3.9)	28 (4.8)	r 16 (3.6)	49 (4.6)	54 (4.9)
Germany	s 0 (0.0)	s 55 (5.1)	s 7 (2.9)	s 18 (4.6)	s 40 (4.7)	s 74 (5.2)	s 81 (4.3)
Greece	32 (4.9)	92 (2.2)	44 (4.3)	58 (4.7)	r 45 (4.3)	87 (3.0)	99 (0.6)
Hong Kong	32 (5.4)	40 (5.4)	40 (5.8)	74 (5.4)	12 (3.7)	68 (5.2)	74 (4.8)
Hungary	34 (4.1)	71 (3.5)	24 (3.6)	43 (4.6)	90 (2.7)	69 (4.2)	87 (2.9)
Iceland	r 45 (8.3)	s 42 (9.0)	s 9 (3.5)	r 92 (3.0)	r 53 (7.0)	r 73 (7.3)	r 68 (6.1)
Iran, Islamic Rep.	22 (3.6)	88 (5.2)	24 (4.0)	60 (5.2)	r 14 (3.3)	r 45 (5.3)	86 (3.8)
Ireland	r 35 (4.7)	r 26 (4.2)	25 (4.3)	75 (4.1)	r 37 (4.9)	r 76 (4.0)	86 (3.6)
Israel	r 77 (6.0)	r 29 (7.4)	r 64 (7.0)	r 61 (7.6)	r 70 (7.7)	r 54 (7.1)	r 46 (6.1)
Japan	16 (2.5)	54 (3.8)	20 (3.2)	44 (3.8)	34 (3.7)	68 (3.7)	71 (3.6)
Korea	36 (3.9)	54 (4.3)	32 (3.8)	24 (3.9)	20 (3.6)	31 (3.8)	62 (3.9)
Kuwait	30 (8.1)	78 (6.4)	77 (5.3)	62 (7.5)	32 (6.4)	61 (5.6)	88 (5.3)
Latvia (LSS)	r 52 (4.7)	r 61 (5.2)	r 33 (4.4)	r 79 (4.3)	r 62 (4.9)	r 83 (3.6)	r 100 (0.0)
Lithuania	r 10 (3.0)	r 31 (4.0)	s 11 (3.1)	r 34 (4.8)	s 16 (3.3)	s 24 (4.5)	r 83 (3.3)
Netherlands	29 (5.8)	99 (1.1)	31 (6.2)	30 (5.4)	14 (4.1)	36 (5.1)	42 (5.6)
New Zealand	14 (2.9)	52 (4.5)	20 (3.3)	34 (4.0)	36 (4.5)	52 (4.3)	46 (4.3)
Norway	r 27 (4.0)	r 100 (0.0)	r 3 (1.6)	r 25 (3.9)	r 15 (3.6)	r 55 (4.6)	r 59 (4.8)
Portugal	14 (2.8)	69 (3.9)	16 (3.4)	79 (3.2)	61 (4.4)	89 (3.1)	97 (1.5)
Romania	48 (4.0)	90 (2.7)	51 (4.2)	81 (3.6)	37 (4.1)	78 (3.7)	97 (1.6)
Russian Federation	- -	100 (0.4)	54 (4.6)	64 (3.9)	52 (5.3)	97 (1.5)	- -
Scotland	- -	- -	- -	- -	- -	- -	- -
Singapore	- -	30 (3.8)	6 (2.2)	72 (4.9)	37 (4.7)	61 (5.2)	70 (4.7)
Slovak Republic	75 (3.8)	97 (1.3)	24 (4.4)	35 (4.7)	36 (4.3)	89 (2.8)	99 (0.9)
Slovenia	r 56 (5.2)	r 76 (4.2)	r 22 (4.4)	r 59 (5.2)	r 44 (5.0)	r 70 (4.0)	r 73 (3.9)
Spain	r 5 (2.1)	r 92 (2.5)	r 23 (3.8)	r 75 (4.3)	r 42 (4.6)	r 90 (2.1)	r 95 (1.7)
Sweden	r 59 (3.2)	r 90 (2.4)	r 19 (2.9)	r 50 (4.3)	r 53 (4.3)	r 87 (2.8)	r 79 (3.2)
Switzerland	s 28 (3.5)	s 77 (4.2)	s 6 (2.1)	s 13 (2.8)	s 14 (2.8)	s 47 (5.1)	s 54 (5.0)
Thailand	s 22 (5.1)	r 52 (6.2)	s 71 (5.0)	s 75 (5.4)	s 21 (4.5)	s 51 (7.0)	s 66 (6.6)
United States	r 20 (2.2)	r 51 (3.7)	r 26 (3.7)	r 57 (3.9)	r 35 (3.3)	r 44 (3.3)	r 45 (3.3)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Table 5.22

Teachers' Reports on Ways Assessment Information Is Used "Quite A Lot" or "A Great Deal" - Mathematics - Upper Grade (Eighth Grade*)

Country	Percent of Students Taught by Teachers Using Assessment Information					
	To Provide Grades or Marks	To Provide Student Feedback	To Diagnose Learning Problems	To Report to Parents	To Assign Students to Programs or Tracks	To Plan for Future Lessons
Australia	r 86 (2.8)	r 89 (2.3)	r 75 (3.5)	r 76 (3.1)	r 55 (3.9)	r 73 (3.0)
Austria	- -	r 72 (3.8)	r 75 (3.7)	r 39 (4.3)	r 17 (3.5)	r 53 (3.9)
Belgium (Fl)	r 70 (4.1)	r 78 (3.7)	r 88 (2.7)	r 80 (3.8)	r 84 (3.3)	r 54 (4.8)
Belgium (Fr)	s 92 (3.1)	s 81 (4.3)	s 92 (2.9)	s 61 (5.6)	- -	s 89 (3.0)
Canada	87 (2.6)	92 (1.8)	84 (3.1)	79 (3.0)	52 (3.6)	79 (3.2)
Colombia	68 (4.3)	90 (2.5)	92 (2.5)	53 (5.2)	37 (5.3)	94 (2.2)
Cyprus	r 100 (0.0)	r 93 (3.2)	r 96 (2.5)	r 96 (2.3)	r 60 (6.0)	r 91 (3.2)
Czech Republic	94 (3.2)	93 (2.7)	100 (0.5)	67 (4.5)	38 (5.2)	98 (1.3)
Denmark	26 (4.3)	85 (3.6)	r 85 (3.6)	54 (5.2)	68 (4.7)	85 (3.6)
England	s 91 (1.8)	s 91 (1.8)	s 84 (2.3)	s 81 (2.7)	s 78 (2.6)	s 85 (2.1)
France	89 (2.9)	93 (2.4)	90 (3.0)	61 (4.3)	36 (4.4)	91 (2.6)
Germany	s 84 (4.3)	s 86 (3.6)	s 89 (3.6)	s 48 (5.5)	s 28 (4.8)	s 86 (3.8)
Greece	97 (1.4)	88 (2.8)	90 (2.0)	89 (3.7)	41 (4.2)	77 (3.4)
Hong Kong	72 (5.1)	82 (4.7)	81 (4.9)	13 (4.1)	13 (4.1)	74 (4.4)
Hungary	58 (4.2)	71 (3.9)	95 (2.0)	81 (3.5)	83 (3.5)	79 (3.7)
Iceland	r 84 (6.2)	r 71 (7.7)	r 82 (6.8)	r 78 (7.3)	r 10 (4.5)	r 91 (4.5)
Iran, Islamic Rep.	83 (3.6)	r 71 (4.1)	81 (3.8)	63 (4.5)	62 (4.2)	79 (3.4)
Ireland	r 72 (4.3)	83 (3.5)	r 84 (3.5)	76 (3.8)	r 54 (4.6)	85 (3.5)
Israel	r 14 (5.9)	r 14 (4.2)	r 20 (5.8)	r 27 (7.3)	r 36 (6.2)	r 7 (3.8)
Japan	73 (3.6)	60 (3.9)	66 (3.6)	9 (2.1)	29 (3.3)	58 (3.9)
Korea	39 (3.7)	42 (4.3)	65 (3.8)	10 (2.7)	3 (1.4)	56 (4.3)
Kuwait	70 (8.0)	75 (6.7)	r 81 (5.8)	r 53 (7.2)	r 66 (5.9)	r 83 (5.7)
Latvia (LSS)	r 97 (1.6)	r 69 (4.3)	r 96 (2.1)	r 39 (4.7)	r 42 (4.9)	r 95 (2.2)
Lithuania	r 78 (4.1)	52 (4.4)	r 54 (4.5)	54 (4.8)	45 (4.6)	r 78 (4.1)
Netherlands	86 (3.6)	68 (5.6)	65 (5.3)	57 (5.7)	68 (5.4)	50 (5.7)
New Zealand	87 (2.9)	87 (2.7)	81 (3.0)	86 (3.1)	45 (4.2)	76 (3.4)
Norway	r 69 (4.6)	r 77 (4.4)	r 47 (5.2)	r 31 (4.1)	r 57 (5.0)	r 82 (3.9)
Portugal	92 (2.3)	80 (3.7)	95 (2.0)	64 (4.5)	43 (4.1)	90 (2.7)
Romania	94 (1.8)	90 (2.5)	94 (1.9)	75 (3.6)	78 (3.1)	95 (1.8)
Russian Federation	90 (2.8)	97 (1.2)	98 (1.2)	25 (4.2)	90 (2.7)	98 (1.0)
Scotland	- -	- -	- -	- -	- -	- -
Singapore	71 (3.7)	87 (3.3)	88 (3.2)	39 (4.4)	31 (4.4)	76 (4.3)
Slovak Republic	74 (4.0)	79 (3.4)	90 (2.7)	68 (4.3)	12 (2.8)	78 (4.2)
Slovenia	r 73 (4.1)	r 97 (2.0)	r 95 (2.4)	r 76 (4.7)	r 40 (5.2)	r 92 (2.9)
Spain	r 95 (2.1)	r 93 (2.3)	r 90 (2.8)	r 86 (3.5)	r 72 (4.1)	r 92 (2.6)
Sweden	r 73 (3.6)	r 91 (2.4)	r 85 (2.9)	r 53 (4.2)	r 32 (3.7)	r 93 (1.9)
Switzerland	s 85 (3.5)	s 92 (2.7)	s 88 (2.9)	s 47 (4.3)	s 23 (3.3)	s 80 (4.2)
Thailand	r 65 (6.2)	r 77 (5.4)	s 84 (4.7)	s 41 (6.4)	s 72 (5.1)	s 87 (4.2)
United States	r 96 (1.0)	r 91 (2.4)	r 80 (2.8)	r 82 (2.6)	r 30 (3.1)	r 86 (2.4)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

A dash (-) indicates data are not available.

An "r" indicates teacher response data available for 70-84% of students. An "s" indicates teacher response data available for 50-69% of students.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table 5.23

Students' Reports on Frequency of Having a Quiz or Test in Their Mathematics Lessons - Upper Grade (Eighth Grade*)

Country	Once in a While or Never		Pretty Often		Almost Always	
	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement	Percent of Students	Mean Achievement
Australia	46 (1.2)	540 (5.1)	38 (0.9)	537 (4.1)	16 (0.9)	501 (6.0)
Austria	77 (1.6)	548 (3.5)	15 (1.2)	525 (5.9)	9 (0.8)	488 (5.6)
Belgium (Fl)	7 (0.8)	558 (12.7)	71 (1.7)	575 (5.8)	22 (2.0)	541 (8.3)
Belgium (Fr)	27 (1.7)	528 (4.9)	49 (1.7)	531 (3.8)	24 (1.2)	521 (5.0)
Canada	27 (1.3)	533 (4.2)	52 (1.2)	535 (2.4)	20 (1.3)	505 (4.0)
Colombia	22 (1.2)	385 (2.8)	35 (0.8)	389 (4.6)	43 (1.4)	388 (3.4)
Cyprus	22 (1.2)	466 (3.8)	63 (1.1)	482 (2.3)	15 (0.8)	455 (4.3)
Czech Republic	72 (1.3)	563 (5.1)	24 (1.2)	572 (6.8)	5 (0.4)	531 (7.5)
Denmark	69 (1.8)	508 (3.3)	21 (1.5)	500 (4.7)	10 (0.9)	489 (6.5)
England	50 (1.4)	511 (3.9)	40 (1.2)	511 (3.5)	10 (0.8)	479 (6.1)
France	30 (1.4)	540 (3.9)	51 (1.4)	543 (3.7)	20 (0.9)	528 (4.4)
Germany	66 (2.0)	521 (4.9)	22 (1.4)	499 (6.2)	12 (1.1)	474 (7.3)
Greece	44 (1.6)	488 (4.0)	40 (1.2)	491 (3.8)	16 (0.8)	458 (3.6)
Hong Kong	21 (2.2)	576 (12.1)	43 (1.3)	604 (5.7)	36 (2.4)	581 (8.3)
Hungary	80 (1.2)	542 (3.3)	15 (0.9)	540 (5.8)	5 (0.6)	486 (8.1)
Iceland	70 (1.7)	490 (4.0)	24 (1.8)	493 (6.1)	6 (1.2)	445 (18.8)
Iran, Islamic Rep.	45 (1.8)	434 (2.9)	28 (1.2)	428 (3.4)	27 (1.2)	425 (3.8)
Ireland	51 (2.1)	536 (6.1)	36 (1.6)	534 (5.6)	14 (1.0)	493 (7.5)
Israel	43 (3.3)	544 (5.8)	39 (2.4)	519 (7.3)	18 (2.0)	488 (8.0)
Japan	59 (2.3)	605 (2.6)	30 (1.6)	608 (4.1)	11 (1.5)	595 (4.7)
Korea	74 (1.5)	610 (2.6)	19 (1.3)	616 (5.3)	7 (0.6)	571 (7.5)
Kuwait	29 (1.7)	389 (3.1)	29 (1.3)	396 (5.1)	42 (2.1)	392 (2.7)
Latvia (LSS)	80 (1.4)	496 (3.0)	17 (1.2)	490 (5.7)	3 (0.4)	465 (11.2)
Lithuania	30 (1.6)	465 (4.3)	59 (1.4)	487 (4.0)	11 (0.8)	462 (7.5)
Netherlands	45 (1.6)	555 (9.5)	43 (1.3)	536 (7.1)	12 (0.9)	515 (7.4)
New Zealand	45 (1.7)	518 (5.3)	35 (1.1)	509 (4.9)	20 (1.2)	489 (5.4)
Norway	66 (1.3)	512 (2.5)	31 (1.3)	494 (3.4)	3 (0.4)	441 (7.5)
Portugal	49 (1.6)	461 (2.7)	28 (1.2)	451 (3.3)	23 (1.0)	446 (2.8)
Romania	30 (1.1)	478 (5.6)	36 (1.1)	490 (4.7)	34 (1.1)	479 (4.6)
Russian Federation	23 (1.5)	524 (5.8)	53 (2.0)	544 (5.9)	24 (1.4)	529 (5.7)
Scotland	63 (1.8)	505 (6.4)	28 (1.4)	498 (6.1)	9 (0.9)	468 (8.7)
Singapore	27 (1.2)	644 (5.6)	55 (1.0)	646 (5.2)	18 (0.9)	635 (6.2)
Slovak Republic	51 (1.6)	554 (4.0)	42 (1.4)	545 (4.2)	7 (0.5)	510 (6.8)
Slovenia	36 (1.6)	550 (4.2)	44 (1.4)	543 (3.4)	20 (1.0)	518 (4.6)
Spain	25 (1.4)	488 (2.8)	37 (1.2)	498 (2.8)	39 (1.3)	478 (2.7)
Sweden	43 (1.6)	522 (3.6)	49 (1.4)	523 (3.2)	7 (0.5)	473 (5.5)
Switzerland	41 (1.2)	550 (4.0)	45 (1.2)	553 (3.2)	14 (0.7)	519 (5.4)
Thailand	41 (1.7)	525 (6.2)	28 (0.9)	527 (6.7)	31 (1.2)	517 (5.9)
United States	15 (0.9)	497 (6.7)	47 (1.1)	517 (4.5)	38 (1.1)	483 (4.8)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3). Background data for Bulgaria and South Africa are unavailable.

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Appendix A

OVERVIEW OF TIMSS PROCEDURES: MATHEMATICS ACHIEVEMENT RESULTS FOR SEVENTH- AND EIGHTH-GRADE STUDENTS

HISTORY

TIMSS represents the continuation of a long series of studies conducted by the International Association for the Evaluation of Educational Achievement (IEA). Since its inception in 1959, the IEA has conducted more than 15 studies of cross-national achievement in curricular areas such as mathematics, science, language, civics, and reading. IEA conducted its First International Mathematics Study (FIMS) in 1964, and the Second International Mathematics Study (SIMS) in 1980-82. The First and Second International Science Studies (FISS and SISS) were conducted in 1970-71 and 1983-84, respectively. Since the subjects of mathematics and science are related in many respects, the third studies were conducted together as an integrated effort.[1]

The number of participating countries and testing both mathematics and science resulted in TIMSS becoming the largest, most complex IEA study to date and the largest international study of educational achievement ever undertaken. Traditionally, IEA studies have systematically worked toward gaining more in-depth understanding of how various factors contribute to the overall outcomes of schooling. Particular emphasis has been given to refining our understanding of students' opportunity to learn as this opportunity becomes successively defined and implemented by curricular and instructional practices. In an effort to extend what had been learned from previous studies and provide contextual and explanatory information, the magnitude of TIMSS expanded beyond the already substantial task of measuring achievement in two subject areas to also include a thorough investigation of curriculum and how it is delivered in classrooms around the world.

THE COMPONENTS OF TIMSS

Continuing the approach of previous IEA studies, TIMSS addressed three conceptual levels of curriculum.[2] The **intended curriculum** is composed of the mathematics and science instructional and learning goals as defined at the system level. The **implemented curriculum** is the mathematics and science curriculum as interpreted by teachers and made available to students. The **attained curriculum** is the mathematics and science content that students have learned and their attitudes towards these subjects. To aid in meaningful interpretation and comparison of results, TIMSS also collected extensive information about the social and cultural contexts for learning, many of which are related to variation among different educational systems.

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[1] Because a substantial amount of time has elapsed since earlier IEA studies in mathematics and science, curriculum and testing methods in these two subjects have undergone many changes. Because TIMSS has devoted considerable energy toward reflecting the most current educational and measurement practices, changes in items and methods as well as differences in the populations tested make comparisons of TIMSS results with those of previous studies very difficult. The focus of TIMSS is not on measuring achievement trends, but rather on providing up-to-date information about the current quality of education in mathematics and science.

Even though slightly fewer countries completed all the steps necessary to have their data included in this report, nearly 50 countries participated in one or more of the various components of the TIMSS data collection effort, including the curriculum analysis. To gather information about the intended curriculum, mathematics and science specialists within each participating country worked section-by-section through curriculum guides, textbooks, and other curricular materials to categorize aspects of these materials in accordance with detailed specifications derived from the TIMSS mathematics and science curriculum frameworks.[2] Initial results from this component of TIMSS can be found in two companion volumes: *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intention in School Mathematics* and *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Science.*[3]

To measure the attained curriculum, TIMSS tested more than half a million students in mathematics and science at five grade levels. TIMSS included testing at three separate populations:

Population 1. Students enrolled in the two adjacent grades that contained the largest proportion of 9-year-old students at the time of testing – third- and fourth-grade students in most countries.

Population 2. Students enrolled in the two adjacent grades that contained the largest proportion of 13-year-old students at the time of testing – seventh- and eighth-grade students in most countries.

Population 3. Students in their final year of secondary education. As an additional option, countries could test two special subgroups of these students:

1) Students taking advanced courses in mathematics, and
2) Students taking physics.

Countries participating in the study were required to administer tests to the students in the two grades at Population 2, but could choose whether or not to participate at the other levels. In about half of the countries at Populations 1 and 2, subsets of the upper-grade students who completed the written tests also participated in a performance assessment. In the performance assessment, students engaged in a number of hands-on

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[2] Robitaille, D.F., McKnight, C., Schmidt, W., Britton, E., Raizen, S., and Nicol, C. (1993). *TIMSS Monograph No. 1: Curriculum Frameworks for Mathematics and Science.* Vancouver, B.C.: Pacific Educational Press.

[3] Schmidt, W.H., McKnight, C.C., Valverde, G.A., Houang, R.T., and Wiley, D.E. (in press). *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Mathematics.* Dordrecht, the Netherlands: Kluwer Academic Publishers. Schmidt, W.H., Raizen, S.A., Britton, E.D., Bianchi, L.J., and Wolfe, R.G. (in press). *Many Visions, Many Aims: A Cross-National Investigation of Curricular Intentions in School Science.* Dordrecht, the Netherlands: Kluwer Academic Publishers.

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mathematics and science activities. The students designed experiments, tested hypotheses, and recorded their findings. For example, in one task, students were asked to investigate probability by repeatedly rolling a die, applying a computational algorithm, and proposing explanations in terms of probability for patterns that emerged. Figure A.1 shows the countries that participated in the various components of TIMSS achievement testing.

TIMSS also administered a broad array of questionnaires to collect data about how the curriculum is implemented in classrooms, including the instructional practices used to deliver it. The questionnaires also were used to collect information about the social and cultural contexts for learning. Questionnaires were administered at the **country level** about decision-making and organizational features within their educational systems. The **students** who were tested answered questions pertaining to their attitudes towards mathematics and science, classroom activities, home background, and out-of-school activities. The mathematics and science **teachers** of sampled students responded to questions about teaching emphasis on the topics in the curriculum frameworks, instructional practices, textbook usage, professional training and education, and their views on mathematics and science. The heads of **schools** responded to questions about school staffing and resources, mathematics and science course offerings, and teacher support. In addition, a volume was compiled that presents descriptions of the educational systems of the participating countries.[4]

With its enormous array of data, TIMSS has numerous possibilities for policy-related research, focused studies related to students' understandings of mathematics and science subtopics and processes, and integrated analyses linking the various components of TIMSS. The initial round of reports is only the beginning of a number of research efforts and publications aimed at increasing our understanding of how mathematics and science education functions across countries, investigating what impacts student performance, and helping to improve mathematics and science education.

Robitaille D.F. (in press). *National Contexts for Mathematics and Science Education: An Encyclopedia of the Education Systems Participating in TIMSS.* Vancouver, B.C.: Pacific Educational Press.

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Figure A.1

Countries Participating in Additional Components of TIMSS Testing

Country	Population 1		Population 2		Population 3		
	Written Test	Performance Assessment	Written Test	Performance Assessment	Mathematics & Science Literacy	Advanced Mathematics	Physics
Argentina			●				
Australia	●	●	●	●	●	●	●
Austria	●		●		●	●	●
Belgium (Fl)			●				
Belgium (Fr)			●				
Bulgaria			●				
Canada	●	●	●	●	●	●	●
Colombia			●	●			
Cyprus	●	●	●	●	●	●	●
Czech Republic	●	●	●	●	●	●	●
Denmark			●	●	●	●	●
England	●		●	●			
France			●		●	●	●
Germany			●		●	●	●
Greece	●		●		●	●	●
Hong Kong	●	●	●	●			
Hungary	●		●		●		
Iceland	●		●		●		
Indonesia	●		●				
Iran, Islamic Rep.	●	●	●	●			
Ireland	●		●				
Israel	●	●	●	●	●	●	●
Italy	●		●		●		
Japan	●		●				●
Korea	●		●				
Kuwait	●		●				
Latvia	●		●				●
Lithuania			●		●	●	
Mexico	●		●		●	●	●
Netherlands	●		●		●		
New Zealand	●	●	●	●	●		
Norway	●		●	●	●		●
Philippines			●				
Portugal	●	●	●	●			
Romania			●	●			
Russian Federation			●		●	●	●
Scotland	●		●	●			
Singapore	●		●	●			
Slovak Republic			●				
Slovenia	●	●	●	●	●	●	●
South Africa			●		●		
Spain			●	●			
Sweden			●	●	●	●	●
Switzerland			●	●	●	●	●
Thailand	●		●				
United States	●	●	●	●	●	●	●

DEVELOPING THE TIMSS MATHEMATICS TEST

The TIMSS curriculum framework underlying the mathematics tests at all three populations was developed by groups of mathematics educators with input from the TIMSS National Research Coordinators (NRCs). As shown in Figure A.2, the mathematics curriculum framework contains three dimensions or aspects. The **content** aspect represents the subject matter content of school mathematics. The **performance expectations** aspect describes, in a non-hierarchical way, the many kinds of performances or behaviors that might be expected of students in school mathematics. The **perspectives** aspect focuses on the development of students' attitudes, interest, and motivations in mathematics.[5]

Working within the mathematics curriculum framework, mathematics test specifications were developed for Population 2 that included items representing a wide range of mathematics topics and eliciting a range of skills from the students. The tests were developed through an international consensus involving input from experts in mathematics and measurement specialists. The TIMSS Subject Matter Advisory Committee, including distinguished scholars from 10 countries, ensured that the test reflected current thinking and priorities within the field of mathematics. The items underwent an iterative development and review process, with one of the pilot testing efforts involving 43 countries. Every effort was made to help ensure that the tests represented the curricula of the participating countries and that the items did not exhibit any bias towards or against particular countries, including modifying specifications in accordance with data from the curriculum analysis component, obtaining ratings of the items by subject matter specialists within the participating countries, and conducting thorough statistical item analysis of data collected in the pilot testing. The final forms of the test were endorsed by the NRCs of the participating countries.[6] In addition, countries had an opportunity to match the content of the test to their curricula at the seventh and eighth grades. They identified items measuring topics not covered in their intended curriculum. The information from this Test-Curriculum Matching Analysis indicates that omitting such items has little effect on the overall pattern of results (see Appendix B).

Table A.1 presents the six content areas included in the Population 2 mathematics test and the numbers of items and score points in each category. Distributions also are included for the four performance categories derived from the performance expectations aspect of the curriculum framework. Approximately one-fourth of the items were in the free-response format, requiring students to generate and write their own answers. Designed to represent approximately one-third of students' response

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[5] The complete TIMSS curriculum frameworks can be found in Robitaille, D.F. et al. (1993). *TIMSS Monograph No. 1: Curriculum Frameworks for Mathematics and Science.* Vancouver, B.C.: Pacific Educational Press.

[6] For a full discussion of the TIMSS test development effort, please see: Garden, R.A. and Orpwood, G. (1996). "TIMSS Test Development" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume I.* Chestnut Hill, MA: Boston College; and Garden, R.A. (1996). "Development of the TIMSS Achievement Items" in D.F. Robitaille and R.A. Garden (eds.), *TIMSS Monograph No. 2: Research Questions and Study Design.* Vancouver, B.C.: Pacific Educational Press.

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Figure A.2

The Three Aspects and Major Categories of the Mathematics Framework

Content

- Numbers
- Measurement
- Geometry
- Proportionality
- Functions, relations, and equations
- Data representation, probability, and statistics
- Elementary Analysis
- Validation and structure

Performance Expectations

- Knowing
- Using routine procedures
- Investigating and problem solving
- Mathematical reasoning
- Communicating

Perspectives

- Attitudes
- Careers
- Participation
- Increasing interest
- Habits of mind

Table A.1

Distribution of Mathematics Items by Content Reporting Category and Performance Category - Population 2

Content Category	Percentage of Items	Total Number of Items	Number of Multiple-Choice Items	Number of Short-Answer Items	Number of Extended-Response Items	Number of Score Points[1]
Fractions and Number Sense	34	51	41	9	1	52
Geometry	15	23	22	1	0	23
Algebra	18	27	22	3	2	30
Data Representation, Analysis and Probability	14	21	19	1	1	23
Measurement[2]	12	18	13	3	2	23
Proportionality	7	11	8	2	1	12

Performance Category	Percentage of Items	Total Number of Items	Number of Multiple-Choice Items	Number of Short-Answer Items	Number of Extended-Response Items	Number of Score Points[1]
Knowing	22	33	31	2	0	33
Performing Routine Procedures	25	38	32	6	0	38
Using Complex Procedures	21	32	28	4	0	32
Solving Problems[3]	32	48	34	7	7	60

[1] In scoring the tests correct answers to most items were worth one point. However, responses to some constructed-response items were evaluated for partial credit with a fully correct answer awarded up to three points. In addition, some items had two parts. Thus the number of score points exceeds the number of items in the test.

[2] One item in the Measurement category was deleted prior to analysis due to poor performing item statistics.

[3] Includes two extended-response items classified as "Justifying and Proving" and two extended-response items classified as "Communicating."

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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time, some free-response questions asked for short answers while others required extended responses where students needed to show their work. The remaining questions used a multiple-choice format. In scoring the tests, correct answers to most questions were worth one point. Consistent with the approach of allotting students longer response time for the constructed-response questions than for multiple-choice questions, however, responses to some of these questions (particularly those requiring extended responses) were evaluated for partial credit with a fully correct answer being awarded two or even three points (see later section on scoring). This, in addition to the fact that several items had two parts, means that the total number of score points available for analysis somewhat exceeds the number of items included in the test.

The TIMSS instruments were prepared in English and translated into 30 additional languages. In addition, it sometimes was necessary to adapt the international versions for cultural purposes, including the 11 countries that tested in English. This process represented an enormous effort for the national centers, with many checks along the way. The translation effort included: 1) developing explicit guidelines for translation and cultural adaptation, 2) translation of the instruments by the national centers in accordance with the guidelines and using two or more independent translations, 3) consultation with subject-matter experts regarding cultural adaptations to ensure that the meaning and difficulty of items did not change, 4) verification of the quality of the translations by professional translators from an independent translation company, 5) corrections by the national centers in accordance with the suggestions made, 6) verification that corrections were implemented, and 7) a series of statistical checks after the testing to detect items that did not perform comparably across countries.[7]

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[7] More details about the translation verification procedures can be found in Mullis, I.V.S., Kelly, D.L., and Haley, K. (1996). "Translation Verification Procedures" in M.O. Martin and I.V.S. Mullis (eds.), *Third International Mathematics and Science Study: Quality Assurance in Data Collection*. Chestnut Hill, MA: Boston College; and Maxwell, B. (1996). "Translation and Cultural Adaptation of the TIMSS Instruments" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume I*. Chestnut Hill, MA: Boston College.

TIMSS TEST DESIGN

Not all of the students in Population 2 responded to all of the mathematics items. To ensure broad subject matter coverage without overburdening individual students, TIMSS used a rotated design that included both the mathematics and science items. Thus, the same students participated in both the mathematics and science testing. The TIMSS Population 2 test consisted of eight booklets, with each booklet requiring 90 minutes of student response time. In accordance with the design, the mathematics and science items were assembled into 26 different clusters (labeled A through Z). Eight of the clusters were designed to take students 12 minutes to complete; 10 of the clusters, 22 minutes; and 8 clusters, 10 minutes. In all, the design provided a total of 396 unique testing minutes, 198 for mathematics and 198 for science. Cluster A was a core cluster assigned to all booklets. The remaining clusters were assigned to the booklets in accordance with the rotated design so that representative samples of students responded to each cluster.[8]

SAMPLE IMPLEMENTATION AND PARTICIPATION RATES

The selection of valid and efficient samples is crucial to the quality and success of an international comparative study such as TIMSS. The accuracy of the survey results depends on the quality of sampling information available and on the quality of the sampling activities themselves. For TIMSS, NRCs worked on all phases of sampling with staff from Statistics Canada. NRCs received training in how to select the school and student samples and in the use of the sampling software. In consultation with the TIMSS sampling referee (Keith Rust, WESTAT, Inc.), staff from Statistics Canada reviewed the national sampling plans, sampling data, sampling frames, and sample execution. This documentation was used by the International Study Center in consultation with Statistics Canada, the sampling referee, and the Technical Advisory Committee, to evaluate the quality of the samples.

In a few situations where it was not possible to implement TIMSS testing for the entire internationally desired definition of Population 2 (all students in the two adjacent grades with the greatest proportion of 13-year-olds), countries were permitted to define a national desired population which did not include part of the internationally desired population. Table A.2 shows any differences in coverage between the international and national desired populations. Most participants achieved 100% coverage (36 out of 42). The countries with less than 100% coverage are annotated in tables in this report. In some instances, countries, as a matter of practicality, needed to define their tested population according to the structure of school systems, but in Germany and Switzerland, parts of the country were simply unwilling to take part in TIMSS. Because coverage fell below 65% for Latvia, the Latvian results have been labeled "Latvia (LSS)," for Latvian Speaking Schools, throughout the report.

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[8] The design is fully documented in Adams, R. and Gonzalez, E. (1996). "Design of the TIMSS Achievement Instruments" in D.F. Robitaille and R.A. Garden (eds.), *TIMSS Monograph No. 2: Research Questions and Study Design*. Vancouver, B.C.: Pacific Education Press; and Adams, R. and Gonzalez, E. (1996). "TIMSS Test Design" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume I*. Chestnut Hill, MA: Boston College.

Table A.2

Coverage of TIMSS Target Population

The International Desired Population is defined as follows:
Population 2 - All students enrolled in the two adjacent grades with the largest proportion of 13-year-old students at the time of testing.

Country	International Desired Population		National Desired Population		
	Coverage	Notes on Coverage	School-Level Exclusions	Within-Sample Exclusions	Overall Exclusions
Australia	100%		0.2%	0.7%	0.8%
Austria	100%		2.9%	0.2%	3.1%
Belgium (Fl)	100%		3.8%	0.0%	3.8%
Belgium (Fr)	100%		4.5%	0.0%	4.5%
Bulgaria	100%		0.6%	0.0%	0.6%
Canada	100%		2.4%	2.1%	4.5%
Colombia	100%		3.8%	0.0%	3.8%
Cyprus	100%		0.0%	0.0%	0.0%
Czech Republic	100%		4.9%	0.0%	4.9%
Denmark	100%		0.0%	0.0%	0.0%
[2] England	100%		8.4%	2.9%	11.3%
France	100%		2.0%	0.0%	2.0%
[1] Germany	88%	15 of 16 regions*	8.8%	0.9%	9.7%
Greece	100%		1.5%	1.3%	2.8%
Hong Kong	100%		2.0%	0.0%	2.0%
Hungary	100%		3.8%	0.0%	3.8%
Iceland	100%		1.7%	2.9%	4.5%
Iran, Islamic Rep.	100%		0.3%	0.0%	0.3%
Ireland	100%		0.0%	0.4%	0.4%
[1] Israel	74%	Hebrew Public Education System	3.1%	0.0%	3.1%
Japan	100%		0.6%	0.0%	0.6%
Korea	100%		2.2%	1.6%	3.8%
Kuwait	100%		0.0%	0.0%	0.0%
[1] Latvia (LSS)	51%	Latvian-speaking schools	2.9%	0.0%	2.9%
[1] Lithuania	84%	Lithuanian-speaking schools	6.6%	0.0%	6.6%
Netherlands	100%		1.2%	0.0%	1.2%
New Zealand	100%		1.3%	0.4%	1.7%
Norway	100%		0.3%	1.9%	2.2%
Philippines	91%	2 provinces and autonomous regions excluded	6.5%	0.0%	6.5%
Portugal	100%		0.0%	0.3%	0.3%
Romania	100%		2.8%	0.0%	2.8%
Russian Federation	100%		6.1%	0.2%	6.3%
Scotland	100%		0.3%	1.9%	2.2%
Singapore	100%		4.6%	0.0%	4.6%
Slovak Republic	100%		7.4%	0.1%	7.4%
Slovenia	100%		2.4%	0.2%	2.6%
South Africa	100%		9.6%	0.0%	9.6%
Spain	100%		6.0%	2.7%	8.7%
Sweden	100%		0.0%	0.9%	0.9%
[1] Switzerland	86%	22 of 26 cantons	4.4%	0.8%	5.3%
Thailand	100%		6.2%	0.0%	6.2%
United States	100%		0.4%	1.7%	2.1%

[1] National Desired Population does not cover all of International Desired Population. Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population.

* One region (Baden-Wuerttemberg) did not participate.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Within the desired population, countries could define a population that excluded a small percent (less than 10%) of certain kinds of schools or students that would be very difficult or resource intensive to test (e. g., schools for students with special needs or schools that were very small or located in extremely remote areas). Table A.2 also shows that the degree of such exclusions was small. Only England exceeded the 10% limit, and this is annotated in the tables in this report.

Countries were required to test the two adjacent grades with the greatest proportion of 13-year-olds. Table A.3 presents, for each country, the percentage of 13-year-olds in the lower grade tested, the percentage in the upper grade, and the percentage in both the upper and lower grades combined.

Within countries, TIMSS used a two-stage sample design at Population 2, where the first stage involved selecting 150 public and private schools within each country. Within each school, the basic approach required countries to use random procedures to select one mathematics class at the eighth grade and one at the seventh grade (or the corresponding upper and lower grades in that country). All of the students in those two classes were to participate in the TIMSS testing. This approach was designed to yield a representative sample of 7,500 students per country, with approximately 3,750 students at each grade.[7] Typically, between 450 and 3,750 students responded to each item at each grade level, depending on the booklets in which the items were located.

Countries were required to obtain a participation rate of at least 85% of both schools and students, or a combined rate (the product of school and student participation) of 75%. Tables A.4 through A.8 present the participation rates and achieved sample sizes for the eighth and seventh grades.

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[7] The sample design for TIMSS is described in detail in Foy, P., Rust, K. and Schleicher, A. (1996). "TIMSS Sample Design" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume I*. Chestnut Hill, MA: Boston College.

Table A.3
Coverage of 13-Year-Old Students

Country	Percent of 13-Year-Olds in Lower Grade (Seventh Grade*)	Percent of 13-Year-Olds in Upper Grade (Eighth Grade*)	Percent of 13-Year-Olds in Both Grades
Australia	64	28	92
Austria	62	27	89
Belgium (Fl)	46	49	94
Belgium (Fr)	41	46	87
Bulgaria	58	37	95
Canada	48	43	91
Colombia	30	15	45
Cyprus	28	70	98
Czech Republic	73	17	90
Denmark	35	64	98
England	57	42	99
France	44	35	78
Germany	71	2	73
Greece	11	85	96
Hong Kong	44	46	90
Hungary	65	24	89
Iceland	16	83	100
Iran, Islamic Rep.	47	25	72
Ireland	69	17	86
Israel	–	–	–
Japan	91	9	100
Korea	70	28	98
Kuwait	–	–	–
Latvia (LSS)	60	26	86
Lithuania	64	26	90
Netherlands	59	31	90
New Zealand	52	47	99
Norway	43	57	100
Philippines	–	–	–
Portugal	44	32	76
Romania	67	9	76
Russian Federation	50	44	95
Scotland	24	75	99
Singapore	82	15	97
Slovak Republic	73	22	95
Slovenia	65	2	67
South Africa	36	20	55
Spain	46	39	85
Sweden	45	54	99
Switzerland	48	44	92
Thailand	58	20	78
United States	58	33	91

*Seventh and eighth grades in most countries; see Table 2 for more information about the grades tested in each country.

A dash (–) indicates data are unavailable. Israel and Kuwait did not test the lower (seventh) grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table A.4

School Participation Rates and Sample Sizes - Upper Grade (Eighth Grade*)

Country	School Participation Before Replacement (Weighted Percentage)	School Participation After Replacement (Weighted Percentage)	Number of Schools in Original Sample	Number of Eligible Schools in Original Sample	Number of Schools in Original Sample That Participated	Number of Replacement Schools That Participated	Total Number of Schools That Participated
Australia	75	77	**214**	**214**	**158**	**3**	**161**
Austria	41	84	159	159	62	62	124
Belgium (Fl)	61	94	150	150	92	49	141
Belgium (Fr)	57	79	150	150	85	34	119
Bulgaria	72	74	167	167	111	4	115
Canada	90	91	413	388	363	1	364
Colombia	91	93	150	150	136	4	140
Cyprus	100	100	55	55	55	0	55
Czech Republic	96	100	150	149	143	6	149
Denmark	93	93	158	157	144	0	144
England	56	85	150	144	80	41	121
France	86	86	151	151	127	0	127
Germany	72	93	153	150	102	32	134
Greece	87	87	180	180	156	0	156
Hong Kong	82	82	105	104	85	0	85
Hungary	100	100	150	150	150	0	150
Iceland	98	98	161	132	129	0	129
Iran, Islamic Rep.	100	100	192	191	191	0	191
Ireland	84	89	150	149	125	7	132
Israel	45	46	100	100	45	1	46
Japan	92	95	158	158	146	5	151
Korea	100	100	150	150	150	0	150
Kuwait	100	100	69	69	69	0	69
Latvia (LSS)	83	83	170	169	140	1	141
Lithuania	96	96	151	151	145	0	145
Netherlands	24	63	150	150	36	59	95
New Zealand	91	99	150	150	137	12	149
Norway	91	97	150	150	136	10	146
Philippines	96 **	97 **	200	200	192	1	193
Portugal	95	95	150	150	142	0	142
Romania	94	94	176	176	163	0	163
Russian Federation	97	100	175	175	170	4	174
Scotland	79	83	153	153	119	8	127
Singapore	100	100	137	137	137	0	137
Slovak Republic	91	97	150	150	136	9	145
Slovenia	81	81	150	150	121	0	121
South Africa	60	64	180	180	107	7	114
Spain	96	100	155	154	147	6	153
Sweden	97	97	120	120	116	0	116
Switzerland	93	95	259	258	247	3	250
Thailand	99	99	150	150	147	0	147
United States	77	85	220	217	169	14	183

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

**Participation rates for the Philippines are unweighted.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table A.5

Student Participation Rates and Sample Sizes - Upper Grade (Eighth Grade*)

Country	Within School Student Participation (Weighted Percentage)	Number of Sampled Students in Participating Schools	Number of Students Withdrawn from Class School	Number of Students Excluded	Number of Students Eligible	Number of Students Absent	Total Number of Students Assessed
Australia	**92**	**8027**	**63**	**61**	**7903**	**650**	**7253**
Austria	95	2969	14	4	2951	178	2773
Belgium (Fl)	97	2979	1	0	2978	84	2894
Belgium (Fr)	91	2824	0	1	2823	232	2591
Bulgaria	86	2300	0	0	2300	327	1973
Canada	93	9240	134	206	8900	538	8362
Colombia	94	2843	6	0	2837	188	2649
Cyprus	97	3045	15	0	3030	107	2923
Czech Republic	92	3608	6	0	3602	275	3327
Denmark	93	2487	0	0	2487	190	2297
England	91	2015	37	60	1918	142	1776
France	95	3141	0	0	3141	143	2998
Germany	87	3318	0	35	3283	413	2870
Greece	97	4154	27	23	4104	114	3990
Hong Kong	98	3415	12	0	3403	64	3339
Hungary	87	3339	0	0	3339	427	2912
Iceland	90	2025	10	65	1950	177	1773
Iran, Islamic Rep.	98	3770	20	0	3750	56	3694
Ireland	91	3411	28	10	3373	297	3076
Israel	98	1453	6	0	1447	32	1415
Japan	95	5441	0	0	5441	300	5141
Korea	95	2998	31	0	2967	47	2920
Kuwait	83	1980	3	0	1977	322	1655
Latvia (LSS)	90	2705	19	0	2686	277	2409
Lithuania	87	2915	2	0	2913	388	2525
Netherlands	95	2112	14	1	2097	110	1987
New Zealand	94	4038	121	12	3905	222	3683
Norway	96	3482	26	49	3407	140	3267
Philippines	91 **	6586	93	0	6493	492	6001
Portugal	97	3589	70	13	3506	115	3391
Romania	96	3899	0	0	3899	174	3725
Russian Federation	95	4311	42	10	4259	237	4022
Scotland	88	3289	0	46	3243	380	2863
Singapore	95	4910	18	0	4892	248	4644
Slovak Republic	95	3718	5	3	3710	209	3501
Slovenia	95	2869	15	8	2846	138	2708
South Africa	97	4793	0	0	4793	302	4491
Spain	95	4198	27	102	4069	214	3855
Sweden	93	4483	71	28	4384	309	4075
Switzerland	98	4989	16	24	4949	94	4855
Thailand	100	5850	0	0	5850	0	5850
United States	92	8026	104	108	7814	727	7087

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.
**Participation rates for the Philippines are unweighted.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table A.6

School Participation Rates and Sample Sizes - Lower Grade (Seventh Grade*)

Country	School Participation Before Replacement (Weighted Percentage)	School Participation After Replacement (Weighted Percentage)	Number of Schools in Original Sample	Number of Eligible Schools in Original Sample	Number of Schools in Original Sample That Participated	Number of Replacement Schools That Participated	Total Number of Schools That Participated
Australia	75	76	214	213	156	3	159
Austria	43	86	159	159	63	62	125
Belgium (Fl)	61	93	150	150	91	49	140
Belgium (Fr)	57	80	150	150	85	35	120
Bulgaria	75	77	150	150	101	3	104
Canada	90	90	413	390	366	1	367
Colombia	91	93	150	150	136	4	140
Cyprus	100	100	55	55	55	0	55
Czech Republic	96	100	150	150	144	6	150
Denmark	88	88	158	154	137	0	137
England	57	85	150	145	81	41	122
France	87	87	151	151	126	0	126
Germany	70	90	153	153	101	31	132
Greece	87	87	180	180	156	0	156
Hong Kong	83	83	105	104	86	0	86
Hungary	99	99	150	150	149	0	149
Iceland	97	97	161	149	144	0	144
Iran, Islamic Rep.	100	100	192	192	192	0	192
Ireland	82	87	150	148	122	7	129
Israel	–	–	–	–	–	–	–
Japan	92	95	158	158	146	5	151
Korea	100	100	150	150	150	0	150
Kuwait	–	–	–	–	–	–	–
Latvia (LSS)	83	84	170	169	141	1	142
Lithuania	96	96	151	151	145	0	145
Netherlands	23	61	150	150	34	58	92
New Zealand	90	99	150	150	135	13	148
Norway	84	96	150	147	124	17	141
Philippines	97 **	97 **	200	200	194	0	194
Portugal	94	94	150	150	141	0	141
Romania	94	94	176	175	162	0	162
Russian Federation	97	100	175	175	170	4	174
Scotland	79	85	153	153	120	9	129
Singapore	100	100	137	137	137	0	137
Slovak Republic	91	97	150	150	136	9	145
Slovenia	81	81	150	150	122	0	122
South Africa	83	85	161	161	133	4	137
Spain	96	100	155	154	147	6	153
Sweden	96	96	160	160	154	0	154
Switzerland	90	94	217	217	200	6	206
Thailand	99	99	150	150	146	0	146
United States	77	84	220	214	165	14	179

*Seventh grade in most countries; see Table 2 for more information about the grades tested in each country.

**Participation rates for the Philippines are unweighted.

A dash (–) indicates data are unavailable. Israel and Kuwait did not test the lower grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table A.7

Student Participation Rates and Sample Sizes - Lower Grade (Seventh Grade*)

Country	Within School Student Participation (Weighted Percentage)	Number of Sampled Students in Participating Schools	Number of Students Withdrawn from Class School	Number of Students Excluded	Number of Students Eligible	Number of Students Absent	Total Number of Students Assessed
Australia	**93**	**6067**	**26**	**21**	**6020**	**421**	**5599**
Austria	95	3196	22	5	3169	156	3013
Belgium (Fl)	97	2857	3	0	2854	86	2768
Belgium (Fr)	95	2418	0	1	2417	125	2292
Bulgaria	87	2080	0	0	2080	282	1798
Canada	95	8962	89	248	8625	406	8219
Colombia	93	2840	2	0	2838	183	2655
Cyprus	98	3028	17	0	3011	82	2929
Czech Republic	92	3641	11	0	3630	285	3345
Denmark	86	2408	0	0	2408	335	2073
England	92	2031	31	67	1933	130	1803
France	95	3164	0	0	3164	148	3016
Germany	87	3388	0	37	3351	458	2893
Greece	97	4166	30	78	4058	127	3931
Hong Kong	98	3507	11	0	3496	83	3413
Hungary	94	3266	0	0	3266	200	3066
Iceland	92	2243	11	72	2160	203	1957
Iran, Islamic Rep.	99	3789	18	0	3771	36	3735
Ireland	91	3480	23	17	3440	313	3127
Israel	–	–	–	–	–	–	–
Japan	96	5337	0	0	5337	207	5130
Korea	94	2996	51	0	2945	38	2907
Kuwait	–	–	–	–	–	–	–
Latvia (LSS)	91	2853	7	0	2846	279	2567
Lithuania	89	2852	3	0	2849	318	2531
Netherlands	95	2220	23	0	2197	100	2097
New Zealand	95	3471	98	17	3356	172	3184
Norway	96	2629	8	53	2568	99	2469
Philippines	93 **	6283	29	1	6253	401	5852
Portugal	96	3594	80	4	3510	148	3362
Romania	95	3938	0	0	3938	192	3746
Russian Federation	96	4408	39	11	4358	220	4138
Scotland	90	3313	0	81	3232	319	2913
Singapore	98	3744	19	0	3725	84	3641
Slovak Republic	95	3797	10	3	3784	184	3600
Slovenia	95	3058	12	4	3042	144	2898
South Africa	96	5532	0	0	5532	231	5301
Spain	95	4087	38	116	3933	192	3741
Sweden	95	3055	27	36	2992	161	2831
Switzerland	99	4199	14	44	4141	56	4085
Thailand	100	5845	0	0	5845	0	5845
United States	94	4295	42	85	4168	282	3886

*Seventh grade in most countries; see Table 2 for more information about the grades tested in each country.

**Participation rates for the Philippines are unweighted.

A dash (–) indicates data are unavailable. Israel and Kuwait did not test the lower grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table A.8

Overall Participation Rates
Upper and Lower Grades (Eighth and Seventh Grades*)

Country	Upper Grade		Lower Grade	
	Overall Participation Before Replacement (Weighted Percentage)	Overall Participation After Replacement (Weighted Percentage)	Overall Participation Before Replacement (Weighted Percentage)	Overall Participation After Replacement (Weighted Percentage)
Australia	69	70	69	71
Austria	39	80	41	82
Belgium (Fl)	59	91	59	91
Belgium (Fr)	52	72	54	76
Bulgaria	62	63	65	67
Canada	84	84	86	86
Colombia	85	87	84	86
Cyprus	97	97	98	98
Czech Republic	89	92	88	92
Denmark	86	86	76	76
England	51	77	52	78
France	82	82	82	82
Germany	63	81	61	78
Greece	84	84	84	84
Hong Kong	81	81	81	81
Hungary	87	87	93	93
Iceland	88	88	89	89
Iran, Islamic Rep.	98	98	99	99
Ireland	76	81	75	79
Israel	44	45	–	–
Japan	87	90	88	91
Korea	95	95	94	94
Kuwait	83	83	–	–
Latvia (LSS)	75	75	75	76
Lithuania	83	83	86	86
Netherlands	23	60	22	58
New Zealand	86	94	85	94
Norway	87	93	81	92
Philippines	87 **	88 **	90 **	90 **
Portugal	92	92	90	90
Romania	89	89	89	89
Russian Federation	93	95	93	95
Scotland	69	73	71	73
Singapore	95	95	98	98
Slovak Republic	86	91	86	92
Slovenia	77	77	77	77
South Africa	58	62	79	82
Spain	91	94	91	95
Sweden	90	90	91	91
Switzerland	92	94	89	93
Thailand	99	99	99	99
United States	71	78	72	79

*Seventh and eighth grades in most countries; see Table 2 for information about the grades tested in each country.

** Participation rates for the Philippines are unweighted.

A dash (–) indicates data are unavailable. Israel and Kuwait did not test the lower grade.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

INDICATING COMPLIANCE WITH SAMPLING GUIDELINES IN THE REPORT

Figure A.3 shows how countries have been grouped in tables reporting achievement results. Countries that achieved acceptable participation rates – 85% of both the schools and students, or a combined rate (the product of school and student participation) of 75% – with or without replacement schools, and that complied with the TIMSS guidelines for grade selection and classroom sampling are shown in the first panel of Figure A.3. Countries that met the guidelines only after including replacement schools are annotated. These countries (25 at the eighth grade and 27 at the seventh grade) appear in the tables in Chapters 1, 2, and 3 ordered by achievement.

Countries not reaching at least 50% school participation without the use of replacements schools, or that failed to reach the sampling participation standard even with the inclusion of replacement schools, are shown in the second panel of Figure A.3. These countries are presented in a separate section of the achievement tables in Chapters 1, 2, and 3 in alphabetical order, and are shown in tables in Chapters 4 and 5 in italics.

To provide a better curricular match, four countries (i.e., Colombia, Germany, Romania, and Slovenia) elected to test their seventh- and eighth-grade students even though that meant not testing the two grades with the most 13-year-olds and led to their students being somewhat older than those in the other countries. These countries are also presented in a separate section of the achievement tables in Chapters 1, 2, and 3 in alphabetical order, and are shown in tables in Chapter 4 and 5 in italics. Table A.3 shows the percentage of 13-year-olds for each country in the grades tested.

For a variety of reasons, three countries (Denmark, Greece, and Thailand) did not comply with the guidelines for sampling classrooms. Their results are also presented in a separate section of the achievement tables in Chapters 1, 2, and 3 in alphabetical order, and are italicized in tables in Chapter 4 and 5. At the eighth grade, Israel, Kuwait, and South Africa also had difficulty complying with the classroom selection guidelines, but in addition had other difficulties (Kuwait tested a single grade with relatively few 13-year-olds; Israel and South Africa had low sampling participation rates), and so these countries are also presented in separate sections in tables in Chapters 1, 2, and 3, and are italicized in tables in Chapter 4 and 5. At the seventh grade, South Africa had a better sampling participation rate, and is presented in the same section of tables as Denmark, Greece, and Thailand. Israel and Kuwait did not test at the seventh grade.

Because the Philippines was not able to document clearly the school sampling procedures used, its results are not presented in the main body of the report. A small set of results for the Philippines can be found in Appendix C.

Figure A.3

Countries Grouped for Reporting of Achievement According to Their Compliance with Guidelines for Sample Implementation and Participation Rates

Eighth Grade	Seventh Grade
Countries satisfying guidelines for sample participation rates, grade selection and sampling procedures	
[†] Belgium (Fl) Canada Cyprus Czech Republic [†,2] England France Hong Kong Hungary Iceland Iran, Islamic Rep. Ireland Japan Korea [1] Latvia [1] Lithuania New Zealand Norway Portugal Russian Federation Singapore Slovak Republic Spain Sweden [1] Switzerland [†] United States	[†] Belgium (Fr) [†] Belgium (Fl) Canada Cyprus Czech Republic [†,2] England France Hong Kong Hungary Iceland Iran, Islamic Rep. Ireland Japan Korea [1] Latvia (LSS) [1] Lithuania New Zealand Norway Portugal Russian Federation [†] Scotland Singapore Slovak Republic Spain Sweden [1] Switzerland [†] United States
Countries not satisfying guidelines for sample participation	
Australia Austria Belgium (Fr) Bulgaria Netherlands Scotland	Australia Austria Bulgaria Netherlands
Countries not meeting age/grade specifications (high percentage of older students)	
Colombia [†,1] Germany Romania Slovenia	Colombia [†,1] Germany Romania Slovenia
Countries with unapproved sampling procedures at the classroom level	
Denmark Greece Thailand	Denmark Greece [1] South Africa Thailand
Countries with unapproved sampling procedures at classroom level and not meeting other guidelines	
[1] Israel Kuwait South Africa	
Countries with unapproved sampling procedures at school level	
[3] Philippines	[3] Philippines

[†] Met guidelines for sample participation rates only after replacement schools were included.

[1] National Desired Population does not cover all of International Desired Population (see Table 1). Because coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

[2] National Defined Population covers less than 90 percent of National Desired Population (see Table 1).

[3] TIMSS was unable to compute sampling weights for the Philippines. Selected unweighted achievement results for the Philippines are presented in Appendix C.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

DATA COLLECTION

Each participating country was responsible for carrying out all aspects of the data collection, using standardized procedures developed for the study. Training manuals were developed for school coordinators and test administrators that explained procedures for receipt and distribution of materials as well as for the activities related to the testing sessions. The test administrator manuals covered procedures for test security, standardized scripts to regulate directions and timing, rules for answering students' questions, and steps to ensure that identification on the test booklets and questionnaires corresponded to the information on the forms used to track students.

Each country was responsible for conducting quality control procedures and describing this effort as part of the NRC's report documenting procedures used in the study. In addition, the International Study Center considered it essential to establish some method to monitor compliance with standardized procedures. NRCs were asked to nominate a person, such as a retired school teacher, to serve as quality control monitor for their countries, and in almost all cases, the International Study Center adopted the NRCs' first suggestion. The International Study Center developed manuals for the quality control monitors and briefed them in two-day training sessions about TIMSS, the responsibilities of the national centers in conducting the study, and their own roles and responsibilities.

The quality control monitors interviewed the NRCs about data collection plans and procedures. They also selected a sample of approximately 10 schools to visit, where they observed testing sessions and interviewed school coordinators.[10] Quality control monitors observed test administrations and interviewed school coordinators in 37 countries, and interviewed school coordinators or test administrators in 3 additional countries.

The results of the interviews indicate that, in general, NRCs had prepared well for data collection and, despite the heavy demands of the schedule and shortages of resources, were in a position to conduct the data collection in an efficient and professional manner. Similarly, the TIMSS tests appeared to have been administered in compliance with international procedures, including the activities preliminary to the testing session, the activities during the testing sessions, and the school-level activities related to receiving, distributing, and returning materials from the national centers.

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[10] The results of the interviews and observations by the quality control monitors are presented in Martin, M.O., Hoyle, C.D., and Gregory, K.D. (1996). "Monitoring the TIMSS Data Collection" and "Observing the TIMSS Test Administration" both in M.O. Martin and I.V.S. Mullis (eds.), *Third International Mathematics and Science Study: Quality Assurance in Data Collection*. Chestnut Hill, MA: Boston College.

SCORING THE FREE-RESPONSE ITEMS

Because approximately one-third of the written test time was devoted to free-response items, TIMSS needed to develop procedures for reliably evaluating student responses within and across countries. Scoring utilized two-digit codes with rubrics specific to each item. Development of the rubrics was led by the Norwegian TIMSS national center. The first digit designates the correctness level of the response. The second digit, combined with the first digit, represents a diagnostic code used to identify specific types of approaches, strategies, or common errors and misconceptions. Although not specifically used in this report, analyses of responses based on the second digit should provide insight into ways to help students better understand mathematics concepts and problem-solving approaches.

To meet the goal of implementing reliable scoring procedures based on the TIMSS rubrics, the International Study Center prepared guides containing the rubrics and explanations of how to implement them together with example student responses for the various rubric categories. These guides, together with more examples of student responses for practice in applying the rubrics were used as a basis for an ambitious series of regional training sessions. The training sessions were designed to assist representatives of national centers who would then be responsible for training personnel in their respective countries to apply the two-digit codes reliably.[11]

To gather and document empirical information about the within-country agreement among scorers, TIMSS developed a procedure whereby systematic subsamples of approximately 10% of the students' responses were to be coded independently by two different readers. To provide information about the cross-country agreement among scorers, TIMSS conducted a special study at Population 2, where 39 scorers from 21 of the participating countries evaluated common sets of students' responses to more than half of the free-response items.

Table A.9 shows the average and range of the within-country exact percent of agreement between scorers on the free-response items in the Population 2 mathematics test for 26 countries. Unfortunately, lack of resources precluded several countries from providing this information. A very high percent of exact agreement was observed, with averages across the items for the correctness score ranging from 97% to 100% and an overall average of 99% across the 26 countries.

The cross-country coding reliability study involved 350 students' responses for each of 14 mathematics and 17 science items, totaling 10,850 responses in all. The responses were random samples from the within-country reliability samples from seven English-test countries: Australia, Canada, England, Ireland, New Zealand, Singapore, and the United States. The responses were presented to the scorers according to a

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The procedures used in the training sessions are documented in Mullis, I.V.S., Garden, R.A., and Jones, C.A. (1996). "Training for Scoring the TIMSS Free-Response Items" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume I*. Chestnut Hill, MA: Boston College.

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Table A.9

TIMSS Within-Country Free-Response Coding Reliability Data for Population 2 Mathematics Items*

Country	Correctness Score Agreement			Diagnostic Code Agreement		
	Average of Exact Percent Agreement Across Items	Range of Exact Percent Agreement		Average of Exact Percent Agreement Across Items	Range of Exact Percent Agreement	
Australia	**98**	**90**	**100**	**90**	**61**	**98**
Belgium (Fl)	100	98	100	99	92	100
Bulgaria	98	93	100	94	59	100
Canada	98	85	100	92	70	99
Colombia	99	97	100	96	91	100
Czech Republic	98	77	100	95	68	100
England	100	96	100	97	89	100
France	100	96	100	98	93	100
Germany	98	89	100	94	75	100
Hong Kong	99	94	100	96	84	100
Iceland	98	84	100	91	73	100
Iran, Islamic Rep.	98	94	100	93	70	100
Ireland	99	95	100	97	83	100
Japan	100	96	100	99	90	100
Netherlands	98	87	100	91	68	100
New Zealand	99	95	100	95	81	100
Norway	99	90	100	95	79	100
Portugal	98	88	100	93	82	99
Russian Federation	99	94	100	96	84	100
Scotland	97	81	100	89	63	99
Singapore	99	95	100	98	87	100
Slovak Republic	97	84	100	91	70	98
Spain	98	88	100	94	75	100
Sweden	99	90	100	94	75	100
Switzerland	100	95	100	98	83	100
United States	99	95	100	96	85	99
AVERAGE	99	91	100	95	78	100

*Based on 26 mathematics items, including 6 multiple-part items.

Note: Percent agreement was computed separately for each part, and each part was treated as a separate item in computing averages and ranges.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

rotated design whereby each response was coded by 7 to 18 different scorers. This design resulted in a large number of comparisons between coders, approximately 10,000 or more for each item.

Table A.10 presents the percent of exact agreement for the 14 mathematics items and the scorers involved in the international study. For comparison purposes, it also shows the average and range of the percent of exact agreement for each of the items within the 26 countries submitting data about their scoring reliability. The percent of exact agreement for each mathematics item was very high, with only two items having measures below 90% on the correctness score agreement. Also, for the correctness score agreement, all items were well within the range of the within-country results. The TIMSS data from the reliability studies indicate that scoring procedures were extremely robust for the mathematics items, especially for the correctness score used for the analyses in this report.[12]

Details about the reliability studies can be found in Mullis, I.V.S., and Smith, T.A. (1996). "Quality Control Steps for Free-Response Scoring" in M.O. Martin and I.V.S. Mullis (eds.), *Third International Mathematics and Science Study: Quality Assurance in Data Collection*. Chestnut Hill, MA: Boston College.

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Table A.10

Percent Exact Agreement for Coding of Mathematics Items for International and Within-Country Reliability Studies

Item Label	Total Valid Comparisons in International Study	Correctness Score Agreement: International Study	Correctness Score Agreement: Within-Country Study			Diagnostic Code Agreement: International Study	Diagnostic Code Agreement: Within-Country Study		
R13	9150	100	99	96	100	97	97	84	100
[1] T02A	46050	100	100	96	100	98	98	94	100
K02	12600	99	99	95	100	98	97	92	100
O06	46050	99	99	96	100	99	98	87	100
K05	45985	99	100	96	100	97	98	92	100
V04	12600	99	99	98	100	97	98	91	100
Q10	12600	99	99	96	100	95	98	92	100
P16	12600	99	99	94	100	91	95	89	100
R14	9150	99	99	94	100	94	97	90	100
[1] T02B	46050	99	99	95	100	91	94	74	100
[1] U01A	45938	98	100	98	100	95	97	90	100
[1] T01A	12592	97	98	84	100	91	94	77	100
V01	12600	97	99	95	100	93	95	88	99
[1] T01B	12600	96	98	95	100	74	88	68	100
[1] U02A	12600	95	97	90	100	85	92	75	99
V02	12600	91	96	81	100	77	89	72	98
[1] U02B	12592	89	96	84	100	71	88	75	100
[1] U01B	46050	84	93	77	99	61	82	61	97
AVERAGE MATH ITEMS		97	98	92	100	89	94	83	100

Two-part items: each part is analyzed separately.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

TEST RELIABILITY

Table A.11 displays the test reliability coefficient for each country for the lower and upper grades (usually seventh and eighth grades). This coefficient is the median KR-20 reliability across the eight test booklets. Median reliabilities in the lower grade ranged from 0.91 in Hong Kong and Korea to 0.75 in Iran, and in the upper grade from 0.91 in Bulgaria to 0.73 in Kuwait. The international median, shown in the last row of the table is the median of the reliability coefficients for all countries. These international medians are 0.86 for the lower grade and 0.89 for the upper grade.

DATA PROCESSING

To ensure the availability of comparable, high quality data for analysis, TIMSS engaged in a rigorous set of quality control steps to create the international database.[13] TIMSS prepared manuals and software for countries to use in entering their data so the information would be in a standardized international format before being forwarded to the IEA Data Processing Center in Hamburg for creation of the international database. Upon arrival at the IEA Data Processing Center, the data from each country underwent an exhaustive cleaning process. The data cleaning process involved several iterative steps and procedures designed to identify, document, and correct deviations from the international instruments, file structures, and coding schemes. This process also emphasized consistency of information within national data sets and appropriate linking among the many student, teacher, and school data files.

Throughout the process, the data were checked and double-checked by the IEA Data Processing Center, the International Study Center, and the national centers. The national centers were contacted regularly and given multiple opportunities to review the data for their countries. In conjunction with the Australian Council for Educational Research (ACER), the International Study Center conducted a review of item statistics for each of the cognitive items in each of the countries to identify poorly performing items. Twenty-one countries had one or more items deleted (in most cases, one). Usually the poor statistics (negative point-biserials for the key, large item-by-country interactions, and statistics indicating lack of fit with the model) were a result of translation, adaptation, or printing deviations.

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[13] These steps are detailed in Jungclaus, H. and Bruneforth, M. (1996). "Data Consistency Checking Across Countries" in M.O. Martin and D.L. Kelly (eds.), *Third International Mathematics and Science Study Technical Report, Volume I*. Chestnut Hill, MA: Boston College.

Table A.11

Cronbach's Alpha Reliability Coefficients[1] - TIMSS Mathematics Test Lower and Upper Grades (Seventh and Eighth Grades*)

Country	Lower Grade	Upper Grade
Australia	0.89	0.90
Austria	0.88	0.89
Belgium (Fl)	0.84	0.89
Belgium (Fr)	0.85	0.89
Bulgaria	0.90	0.91
Canada	0.86	0.88
Colombia	0.76	0.79
Cyprus	0.85	0.88
Czech Republic	0.89	0.89
Denmark	0.84	0.87
England	0.89	0.90
France	0.84	0.85
Germany	0.88	0.89
Greece	0.88	0.89
Hong Kong	0.91	0.90
Hungary	0.88	0.90
Iceland	0.82	0.87
Iran, Islamic Rep.	0.75	0.78
Ireland	0.88	0.90
Israel	–	0.89
Japan	0.89	0.90
Korea	0.91	0.92
Kuwait	–	0.73
Latvia (LSS)	0.86	0.88
Lithuania	0.84	0.88
Netherlands	0.86	0.89
New Zealand	0.88	0.90
Norway	0.85	0.87
Philippines	0.86	0.87
Portugal	0.77	0.82
Romania	0.87	0.88
Russian Federation	0.88	0.89
Scotland	0.87	0.89
Singapore	0.88	0.83
Slovak Republic	0.87	0.89
Slovenia	0.87	0.89
South Africa	0.79	0.81
Spain	0.83	0.86
Sweden	0.86	0.88
Switzerland	0.84	0.88
Thailand	0.86	0.88
United States	0.89	0.89
International Median	0.86	0.89

*Seventh and eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

Israel and Kuwait did not test the lower grade.

[1] The reliability coefficient for each country is the median KR-20 reliability across the eight test booklets.

The international median is the median of the reliability coefficients for all countries.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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IRT SCALING AND DATA ANALYSIS

Two general analysis approaches were used for this report – item response theory scaling methods and average percent correct technology. The overall mathematics results were summarized using an item response theory (IRT) scaling method (Rasch model). This scaling method produces a mathematics score by averaging the responses of each student to the items which they took in a way that takes into account the difficulty of each item. The methodology used in TIMSS includes refinements that enable reliable scores to be produced even though individual students responded to relatively small subsets of the total mathematics item pool. Analyses of the response patterns of students from participating countries indicated that, although the items in the test address a wide range of mathematical content, the performance of the students across the items was sufficiently consistent to be usefully summarized in a single mathematics score.

The IRT methodology was preferred for developing comparable estimates of performance for all students, since students answered different test items depending upon which of the eight test booklets they received. The IRT analysis provides a common scale on which performance can be compared across countries. In addition to providing a basis for estimating mean achievement, scale scores permit estimates of how students within countries vary and provide information on percentiles of performance. The scale was standardized using students from both the grades tested. When all participating countries and grades are treated equally, the TIMSS scale average is 500 and the standard deviation is 100. Since the countries varied in size, each country was reweighted to contribute equally to the mean and standard deviation of the scale. The average of the scale scores was constructed to be the average of the 41 means of participants that were available at the eighth grade and the 39 means at the seventh grade. The average and standard deviation of the scale scores are arbitrary and do not affect scale interpretations.

The analytic approach underlying the results in Chapters 2 and 3 of this report involved calculating the percentage of correct answers for each item for each participating country (as well as the percentages of different types of incorrect responses). The percents correct were averaged to summarize mathematics performance overall and in each of the content areas for each country as a whole and by gender. For items with more than one part, each part was analyzed separately in calculating the average percents correct. Also, for items with more than one point awarded for full credit, the average percents correct reflect an average of the points received by students in each country. This was achieved by including the percent of students receiving one score point as well as the percentage receiving two score points and three score points in the calculations. Thus, the average percents correct are based on the number of score points rather than the number of items, per se. An exception to this is the international average percents correct reported for example items, where the values reflect the percent of students receiving full credit.

ESTIMATING SAMPLING ERROR

Because the statistics presented in this report are estimates of national performance based on samples of students, rather than the values that could be calculated if every student in every country would have answered every question, it is important to have measures of the degree of uncertainty of the estimates. The jackknife procedure was used to estimate the standard error associated with each statistic presented in this report. The use of confidence intervals, based on the standard errors, provides a way to make inferences about the population means and proportions in a manner that reflects the uncertainty associated with the sample estimates. An estimated sample statistic plus or minus two standard errors represents a 95% confidence interval for the corresponding population result.

Appendix B

THE TEST-CURRICULUM MATCHING ANALYSIS

When comparing student achievement across countries, it is important that the comparisons be as "fair" as possible. TIMSS has worked towards this goal in a number of ways, including providing detailed procedures for standardizing the population definitions, sampling, test translations, test administration, scoring, and database formation. Developing the TIMSS tests involved the interaction of experts in the field of mathematics with representatives of the participating countries and testing specialists.[1] The National Research Coordinators (NRCs) from each country formally approved the TIMSS test, thus accepting it as being sufficiently fair to compare their students' mathematics achievement with that of students from other countries.

Although the TIMSS test was developed to represent a set of agreed-upon mathematics content areas, there are differences among the curricula of participating countries that result in various mathematics topics being taught at different grades. To restrict test items not only to those topics in the curricula of all countries but also to those covered in the same sequence in all participating countries would severely limit test coverage and restrict the research questions about international differences that TIMSS is designed to address. The TIMSS tests, therefore, inevitably contain some items measuring topics unfamiliar to some students in some countries.

The Test-Curriculum Matching Analysis (TCMA) was developed and conducted to investigate the appropriateness of the TIMSS mathematics test for seventh- and eighth-grade students in the participating countries, and to show how student performance for individual countries varied when based only on the test questions that were judged to be relevant to their own curriculum.[2]

To gather data about the extent to which the TIMSS tests were relevant to the curriculum of the participating countries, TIMSS asked the NRC of each country to report whether or not each item was in the country's intended curriculum at each of the two grades being tested. The NRC was asked to choose a person or persons who were very familiar with the curricula at the grades being tested to make the determination. Since an item might be in the curriculum for some but not all students in a country, an item was determined appropriate if it was in the intended curriculum for more than 50% of the students. The NRCs had considerable flexibility in selecting items and may have considered items inappropriate for other reasons. All participating countries except Thailand returned the information for analysis.

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[1] See Appendix A for more information on the test development.

[2] Because there also may be curriculum areas covered in some countries that are not covered by the TIMSS tests, the TCMA does not provide complete information about how well the TIMSS tests cover the curricula of the countries.

Tables B.1 and B.2 present the TCMA results for the eighth and seventh grades, respectively. The first row of each table indicates that at both grades the countries varied substantially in the number of items considered appropriate. At the eighth grade, half of the countries indicated that items representing 90% or more of the score points (145 out of a possible 162) were appropriate,[3] with the percent ranging from 100% in Hungary and the United States to 47% (76 score points) in Greece. Although, in general, fewer items were selected at the seventh grade than at the eighth grade, nearly half of the countries selected items representing at least three-quarters of the score points (121), and several countries selected items representing 90% or more. The number of score points represented by the selected items for the seventh grade ranged from 59 (36%) in Denmark to 162 (100%) in the United States. That somewhat lower percentages of items were selected for the TCMA at the seventh grade is consistent with the instrument-development process, which put more emphasis on the upper-grade curriculum.

Since most countries indicated that some items were not included in their intended curricula at the two grades tested, the question becomes whether the inclusion of these items had any effect on the international performance comparisons.[4] The TCMA results provide a method for answering this question, providing evidence that it is reasonable to make cross-national comparisons on the basis of the TIMSS mathematics test.

Each of the first columns in Tables B.1 and B.2 shows the overall average percent correct for each country (as discussed in Chapter 2 and reproduced here for convenience in making comparisons). The countries are presented in the order of their overall performance, from highest to lowest. To interpret these tables, reading across a row provides the average percent correct for the students in the country identified by that row on the items selected by each of the countries named across the top of the table. For example, eighth-grade Korean students had an average of 71% correct on the items that Singapore selected as appropriate for the Singaporean students, an average of 72% percent correct on the items selected for the Japanese students, 73% correct for its own items, 72% on the items selected by Hong Kong, and so forth. The column for a country shows how each of the other countries performed on the subset of items selected for its own students. Using the set of items selected by Switzerland as an example, on average, 80% of these items were answered correctly by the Singaporean students, 75% by the Japanese students, 72% by the students from Hong Kong, 71% by the Belgian (Flemish) students, and so forth. The shaded diagonal elements in

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[3] Of the 151 items in the test, some items were assigned more score points than others. In particular, some items had two parts, and some extended-response items were scored on a two-point scale and others on a three-point scale. The total number of score points available for analysis was 162. The TCMA uses the score points in order to give the same importance to items that they received in the test scoring.

[4] It should be noted that the performance levels presented in Tables B.1 and B.2 are based on average percents correct as was done in Chapter 2, which is different from the average scale scores that were presented in Chapter 1. The cost and delay of scaling would have been prohibitive for the TCMA analyses.

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Table B.1 Test-Curriculum Matching Analysis Results - Mathematics - Upper Grade (Eighth Grade*)

Average Percent Correct Based on Subsets of Items Specially Identified by Each Country as Addressing Its Curriculum (See Table B.3 for corresponding standard errors)

Instructions: Read ***across*** the row to compare that country's performance based on the test items included by each of the countries across the top
Read ***down*** the column under a country name to compare the performance of the country down the left on the items included by the country listed on the top
Read along the ***diagonal*** to compare performance for each different country based on its own decisions about the test items to include

Country	Average Percent Correct on All Items	Singapore	Japan	Korea	Hong Kong	Belgium (Fl)	Czech Republic	Slovak Republic	Switzerland	*Austria*	Hungary	France	*Slovenia*	Russian Federation	*Netherlands*	*Bulgaria*	Canada	Ireland	*Belgium (Fr)*	*Australia*	*Israel*	Sweden	*Germany*	New Zealand	Norway	England	United States	*Denmark*	*Scotland*	Latvia (LSS)	Spain	Iceland	*Greece*	*Romania*	Lithuania	Cyprus	Portugal	Iran, Islamic Rep.	*Kuwait*	*Colombia*	*South Africa*
	(Number of Score Points Included) 162**	144	153	148	150	140	150	152	133	147	162	140	151	126	116	119	147	145	138	154	159	127	155	145	150	130	162	135	125	161	158	133	76	143	155	124	152	147	140	133	129
Singapore	79 (0.9)	79	79	80	79	79	79	79	80	80	79	79	79	81	79	80	79	79	79	79	79	79	79	79	79	81	79	80	80	79	79	80	79	79	79	80	79	79	79	80	79
Japan	73 (0.4)	73	73	74	73	73	73	73	75	74	73	73	73	74	73	73	74	73	73	74	73	73	73	75	74	75	73	75	74	73	73	74	74	74	73	73	73	74	74	74	73
Korea	72 (0.5)	71	72	73	72	71	72	71	72	72	72	71	71	72	70	72	72	71	71	72	72	71	72	73	72	73	72	73	72	72	72	73	72	72	71	71	72	72	72	72	70
Hong Kong	70 (1.4)	70	70	71	[illegible]	70	70	70	71	71	70	70	70	71	69	71	70	70	69	70	70	69	70	71	70	71	70	71	70	70	70	70	70	70	70	70	70	70	70	71	70
Belgium (Fl)	66 (1.4)	65	65	67	65	[illegible]	65	65	68	66	66	66	65	67	64	65	66	65	65	66	66	67	66	67	66	68	66	67	67	66	65	67	65	66	65	65	65	66	66	66	65
Czech Republic	66 (1.1)	65	66	67	66	66	[illegible]	66	68	66	66	66	66	67	64	65	66	66	65	66	66	66	66	67	66	67	66	67	66	66	65	67	68	66	66	65	66	66	66	66	65
Slovak Republic	62 (0.8)	63	63	64	63	63	63	[illegible]	65	63	62	63	63	64	61	63	63	62	62	63	62	62	63	63	62	64	62	64	62	62	62	64	64	62	63	62	63	63	63	63	63
Switzerland	62 (0.6)	61	62	63	61	61	61	62	[illegible]	62	62	62	61	62	62	60	63	61	60	62	62	64	62	64	62	66	62	64	65	62	62	63	60	61	62	61	62	62	62	61	61
Austria	62 (0.8)	62	62	63	62	61	62	62	64	[illegible]	62	62	61	63	61	61	63	62	61	62	62	64	62	63	62	65	62	64	63	62	62	63	62	62	62	62	62	62	62	62	62
Hungary	62 (0.7)	61	61	63	61	61	61	61	63	62	[illegible]	61	61	62	60	61	62	61	61	62	62	62	62	63	62	63	62	63	61	62	61	62	63	61	61	61	61	62	62	62	61
France	61 (0.8)	61	61	62	61	60	61	61	63	61	61	[illegible]	61	62	60	60	62	61	60	62	61	62	61	63	62	63	61	63	62	61	61	62	60	61	61	60	61	61	62	62	60
Slovenia	61 (0.7)	61	61	62	61	61	61	61	63	62	61	61	[illegible]	63	59	61	62	61	61	62	61	61	61	62	61	63	61	62	61	61	61	62	62	61	61	61	61	62	62	62	61
Russian Federation	60 (1.3)	61	60	61	60	60	60	60	62	61	60	60	60	[illegible]	58	61	61	60	60	61	60	60	60	61	60	61	60	61	60	60	60	61	62	60	60	60	60	61	61	61	60
Netherlands	60 (1.6)	59	60	60	59	58	59	59	61	60	60	59	59	59	[illegible]	58	61	59	58	60	60	62	60	63	61	63	60	62	62	60	59	61	60	59	59	58	60	60	60	59	58
Bulgaria	60 (1.2)	60	59	61	59	59	59	59	61	60	60	59	59	61	57	[illegible]	60	59	59	60	60	58	60	61	60	61	60	61	59	60	60	61	61	60	59	58	60	60	60	61	59
Canada	59 (0.5)	58	58	59	58	58	58	58	60	59	59	58	58	59	58	57	[illegible]	58	57	59	59	60	59	61	59	62	59	61	60	59	58	60	58	59	58	58	59	59	59	58	58
Ireland	59 (1.2)	58	58	59	58	58	58	58	60	59	59	58	58	59	58	57	59	[illegible]	57	59	59	60	58	61	59	62	59	60	60	59	58	60	59	58	58	58	59	59	59	58	58
Belgium (Fr)	59 (0.9)	58	58	60	58	58	58	58	61	59	59	59	58	59	57	58	59	58	[illegible]	59	59	60	59	60	59	62	59	61	60	59	59	59	58	58	58	58	58	59	59	59	58
Australia	58 (0.9)	57	58	59	57	57	58	58	60	58	58	57	57	58	57	56	59	57	56	[illegible]	58	59	58	61	58	61	58	60	60	58	58	59	59	58	58	57	58	59	58	57	57
Israel	57 (1.3)	57	57	59	57	57	57	57	59	58	57	57	57	59	55	57	58	57	57	58	[illegible]	58	57	59	57	59	57	58	57	57	57	58	60	58	57	57	57	58	58	58	57
Sweden	56 (0.7)	55	55	56	55	54	55	55	57	55	56	55	54	55	56	53	57	55	54	56	56	[illegible]	55	59	57	59	56	58	59	55	55	57	53	55	55	54	56	56	56	54	54
Germany	54 (1.1)	53	54	55	53	53	54	53	56	54	54	54	53	54	53	52	55	54	52	54	54	55	[illegible]	56	54	57	54	56	55	54	54	55	54	53	54	53	54	54	54	54	53
New Zealand	54 (1.0)	53	54	54	53	52	53	53	55	54	54	53	53	53	53	51	55	53	52	54	54	56	54	[illegible]	54	57	54	56	57	54	54	55	55	53	53	52	54	55	54	53	52
Norway	54 (0.5)	53	53	54	53	52	53	53	56	54	54	53	53	53	53	51	54	53	52	54	54	56	53	56	[illegible]	57	54	56	56	53	53	55	52	53	53	52	53	54	54	52	52
England	53 (0.7)	52	53	53	52	51	52	52	54	53	53	52	52	52	52	49	54	52	50	53	53	55	53	56	54	[illegible]	53	55	56	53	53	54	55	52	52	51	53	54	53	51	51
United States	53 (1.1)	52	53	54	52	52	53	52	54	53	53	52	52	53	52	51	54	52	51	53	53	54	53	55	53	56	[illegible]	55	54	53	53	54	54	53	53	52	53	54	53	52	52
Denmark	52 (0.7)	51	52	52	52	51	51	52	54	52	52	51	51	52	52	49	53	51	50	53	52	54	52	55	53	56	52	[illegible]	55	52	52	53	53	51	52	50	52	53	52	51	50
Scotland	52 (1.3)	51	51	52	51	50	51	51	53	51	52	50	51	51	51	48	52	51	49	52	52	54	51	55	52	55	52	54	[illegible]	52	51	52	53	51	51	49	52	52	52	50	50
Latvia (LSS)	51 (0.8)	51	51	52	51	51	51	51	53	52	51	51	51	53	50	51	52	51	51	52	51	51	52	53	51	53	51	53	52	51	51	52	53	51	51	50	51	52	52	52	51
Spain	51 (0.5)	50	51	52	51	50	51	51	52	51	51	51	50	51	48	50	51	50	50	51	51	51	51	52	51	53	51	52	51	51	51	52	53	51	51	50	51	51	51	51	50
Iceland	50 (1.1)	49	50	50	49	48	49	49	52	49	50	49	49	49	49	47	50	49	48	50	50	53	49	53	50	54	50	53	53	50	49	[illegible]	49	49	49	48	49	51	50	49	48
Greece	49 (0.7)	49	49	50	49	49	49	49	51	49	49	49	49	50	48	49	50	49	49	50	49	50	49	51	50	52	49	51	50	49	49	50	[illegible]	49	49	49	49	50	50	49	48
Romania	49 (1.0)	49	49	50	49	49	49	49	50	50	49	49	49	51	47	50	49	49	49	49	49	48	49	50	49	50	49	49	48	49	49	49	50	[illegible]	49	49	49	50	49	51	49
Lithuania	48 (0.9)	49	49	49	49	48	49	49	51	49	48	48	48	50	47	48	50	48	48	49	48	49	49	50	49	50	48	50	49	48	49	49	50	48	[illegible]	47	49	49	49	49	48
Cyprus	48 (0.5)	48	47	49	47	47	48	47	49	48	48	48	47	49	46	48	48	47	47	48	48	48	48	49	48	50	48	48	48	48	48	48	48	48	47	47	48	48	48	49	47
Portugal	43 (0.7)	42	43	43	43	42	43	43	45	43	43	42	42	43	41	41	44	42	41	43	43	44	43	45	43	45	43	45	44	43	43	43	44	42	43	41	[illegible]	44	43	43	41
Iran, Islamic Rep.	38 (0.6)	38	38	39	38	38	38	38	39	38	38	38	38	39	37	38	39	37	37	38	38	37	38	39	38	40	38	39	38	38	38	39	39	38	38	37	38	[illegible]	38	39	37
Kuwait	30 (0.7)	29	30	30	29	29	29	29	31	29	30	29	30	30	29	28	30	29	29	30	30	29	30	32	30	31	30	30	30	30	30	30	32	30	30	28	30	30	[illegible]	30	28
Colombia	29 (0.8)	29	29	30	29	29	29	29	31	29	29	29	29	29	28	28	30	29	28	30	29	30	29	31	30	32	29	30	30	29	29	30	31	29	29	28	29	30	30	[illegible]	28
South Africa	24 (1.1)	23	24	25	24	24	24	24	25	24	24	23	24	24	23	24	24	24	24	24	24	24	24	25	24	25	24	24	24	24	24	25	24	24	24	23	24	24	24	24	[illegible]
International Average	**55 (0.9)**	**55**	**55**	**56**	**55**	**54**	**55**	**55**	**57**	**55**	**55**	**55**	**55**	**56**	**54**	**54**	**56**	**55**	**54**	**55**	**55**	**56**	**55**	**57**	**55**	**58**	**55**	**57**	**56**	**55**	**55**	**56**	**56**	**55**	**55**	**54**	**55**	**56**	**55**	**55**	**54**

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country

**Of the 151 items in the mathematics test, some items had two parts and some extended response items were scored on a two- or three-point scale, resulting in 162 total score points

( ) Standard errors for the average percent of correct responses on all items appear in parentheses. Standard errors for scores based on subsets of items are provided in Table

Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3 for details).

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Table B.2 Test-Curriculum Matching Analysis Results - Mathematics - Lower Grade (Seventh Grade*)

Average Percent Correct Based on Subsets of Items Specially Identified by Each Country as Addressing Its Curriculum (See Table B.4 for corresponding standard errors)

Instructions Read ***across*** the row to compare that country's performance based on the test items included by each of the countries across the top
Read ***down*** the column under a country name to compare the performance of the country down the left on the items included by the country listed on the top
Read along the ***diagonal*** to compare performance for each different country based on its own decisions about the test items to include

Country	*Average Percent Correct on All Items*	**Singapore**	**Japan**	**Korea**	**Hong Kong**	**Belgium (Fl)**	**Czech Republic**	*Austria*	*Bulgaria*	*Netherlands*	**Belgium (Fr)**	**Slovak Republic**	**Hungary**	**Ireland**	**Switzerland**	**Russian Federation**	*Slovenia*	*Australia*	**Canada**	**France**	*Germany*	**United States**	**England**	**Sweden**	**New Zealand**	**Scotland**	**Norway**	**Latvia (LSS)**	*Denmark*	*Romania*	**Iceland**	**Spain**	**Cyprus**	*Greece*	**Lithuania**	**Portugal**	**Iran, Islamic Rep.**	*Colombia*	*South Africa*
(Number of Score Points Included)	*162***	*126*	*145*	*144*	*139*	*104*	*145*	*131*	*119*	*81*	*104*	*152*	*158*	*113*	*91*	*121*	*144*	*114*	*87*	*128*	*132*	*162*	*93*	*100*	*115*	*76*	*118*	*150*	*59*	*87*	*102*	*150*	*101*	*108*	*146*	*148*	*128*	*89*	*81*
Singapore	73 (1.3)	74	73	74	74	77	73	76	74	76	74	73	73	75	77	75	74	75	78	73	74	73	76	73	75	78	74	73	78	75	74	72	75	76	73	74	73	77	77
Japan	67 (0.4)	66	68	68	68	70	67	68	67	69	66	67	68	67	70	68	67	71	74	67	68	67	72	68	71	71	69	67	74	67	70	67	67	68	67	67	67	71	70
Korea	67 (0.6)	66	67	[illegible]	68	69	67	68	67	67	65	67	68	66	70	68	67	70	73	66	68	67	70	67	70	70	68	67	75	69	69	67	66	68	67	67	66	70	69
Hong Kong	65 (1.8)	65	66	66	[illegible]	68	65	67	66	67	64	65	66	65	67	67	65	68	69	65	65	65	69	66	68	70	66	65	72	66	66	65	65	67	65	65	65	69	68
Belgium (Fl)	65 (0.8)	65	65	66	65	[illegible]	65	67	65	67	66	64	65	66	71	66	65	70	73	66	66	65	72	67	70	74	68	65	76	66	69	65	65	68	65	65	64	69	70
Czech Republic	57 (1.2)	57	58	59	59	61	[illegible]	59	56	58	58	57	58	57	63	58	57	61	65	58	58	57	63	59	61	64	60	57	69	60	61	57	56	59	57	58	57	62	62
Austria	56 (0.7)	55	56	56	56	59	56	57	54	57	56	55	56	56	62	56	56	60	64	56	57	56	62	59	61	64	59	56	68	57	59	55	55	57	55	56	54	61	60
Bulgaria	55 (1.7)	55	55	57	57	59	55	57	57	53	55	55	56	55	57	57	55	58	60	55	55	55	58	54	58	60	55	55	63	58	57	55	53	56	55	56	56	60	57
Netherlands	55 (1.0)	53	55	56	54	57	55	56	53	[illegible]	56	54	55	54	62	55	55	60	63	55	58	55	65	60	62	65	62	55	69	54	60	56	54	56	54	55	53	59	59
Belgium (Fr)	54 (0.9)	53	55	55	55	57	54	56	53	56	56	54	55	55	61	55	54	60	63	55	57	54	62	58	60	64	59	54	68	55	59	54	54	56	54	54	54	60	59
Slovak Republic	54 (0.8)	54	55	56	56	58	55	56	54	54	54	[illegible]	55	54	59	56	54	58	62	54	55	54	59	55	58	60	56	54	65	57	57	54	53	56	54	55	54	59	59
Hungary	54 (0.8)	53	54	55	54	57	54	54	53	54	53	53	[illegible]	53	58	55	53	58	61	53	55	54	60	55	58	60	56	54	64	55	57	53	52	55	53	54	53	58	58
Ireland	53 (1.0)	53	53	54	54	56	53	54	52	55	54	53	54	55	60	54	53	58	61	53	55	53	60	56	58	61	56	54	64	54	56	53	53	55	53	53	52	56	58
Switzerland	53 (0.5)	52	53	53	53	55	53	54	50	57	55	52	53	54	[illegible]	53	53	60	63	54	56	53	62	59	60	65	60	54	68	52	58	53	53	55	53	53	52	58	59
Russian Federation	53 (0.9)	53	53	54	54	56	53	54	53	52	53	53	53	53	57	[illegible]	53	56	59	54	53	53	57	53	55	59	54	53	64	56	55	53	52	55	53	54	53	57	56
Slovenia	53 (0.7)	51	53	53	53	55	53	53	51	53	52	52	53	52	58	54	[illegible]	57	60	52	54	52	58	54	57	59	55	53	65	55	56	53	51	54	52	53	51	58	56
Australia	52 (0.8)	51	52	53	53	55	52	53	50	54	52	52	53	52	59	52	52	57	60	53	54	52	61	57	59	61	57	53	65	51	57	52	51	54	52	52	51	56	56
Canada	52 (0.5)	50	52	52	52	54	51	52	49	54	52	51	52	51	59	51	51	57	61	51	54	52	60	55	58	60	56	52	65	51	56	51	51	53	51	51	50	55	56
France	51 (0.8)	49	51	51	51	52	51	51	49	52	51	50	51	49	56	51	51	55	60	51	53	51	58	54	57	60	55	50	65	51	56	52	49	51	50	51	49	56	54
Germany	49 (1.0)	48	49	49	49	52	49	50	47	51	50	48	49	49	56	49	49	55	59	49	51	49	57	53	56	58	53	49	64	50	54	49	48	51	49	49	47	54	54
United States	48 (1.2)	46	48	48	48	50	48	48	46	50	47	47	48	47	54	47	47	52	56	48	49	[illegible]	55	50	54	55	52	48	59	48	52	47	46	49	47	48	46	51	51
England	47 (0.9)	45	47	47	47	48	47	47	44	47	46	46	47	45	53	45	46	52	55	47	49	47	57	52	54	56	53	47	60	45	52	48	44	47	46	47	45	49	49
Sweden	47 (0.6)	45	47	47	47	48	47	47	44	49	48	46	47	47	55	46	46	53	56	47	49	47	57	[illegible]	55	57	54	47	62	45	53	48	45	47	47	47	44	51	50
New Zealand	46 (0.9)	44	46	46	46	48	46	47	43	48	47	45	47	45	53	45	46	51	54	46	48	46	56	51	[illegible]	55	52	46	59	44	51	47	44	47	46	46	45	49	49
Scotland	44 (0.9)	42	44	44	44	46	44	45	41	46	45	44	45	43	51	43	44	50	53	45	46	44	55	50	51	[illegible]	51	44	58	42	50	45	42	44	43	44	43	47	47
Norway	44 (0.7)	43	45	44	45	46	45	45	42	47	46	43	44	44	52	44	44	50	53	45	47	44	54	50	52	54	[illegible]	45	59	43	50	45	43	45	44	44	42	48	48
Latvia (LSS)	44 (0.7)	43	45	45	45	46	44	45	44	43	44	44	44	43	49	45	44	48	50	45	45	44	50	46	48	50	46	[illegible]	56	47	47	44	42	45	44	44	43	49	47
Denmark	44 (0.5)	42	44	44	44	45	44	44	41	45	44	43	44	43	50	43	43	49	53	44	46	44	54	49	51	54	50	44	60	44	49	44	41	44	43	44	42	48	46
Romania	43 (0.8)	44	44	45	44	46	44	45	44	41	43	43	44	43	45	45	44	45	47	44	43	43	46	43	45	48	44	43	51	47	45	43	42	44	44	44	44	48	44
Iceland	43 (0.7)	42	44	44	44	45	43	44	40	46	44	42	44	42	51	42	43	49	53	43	46	43	54	50	51	54	50	43	60	41	[illegible]	44	41	44	42	43	42	47	47
Spain	42 (0.6)	41	42	43	43	44	42	42	41	41	42	42	43	41	47	43	42	46	48	43	43	42	49	44	47	49	46	42	55	43	46	[illegible]	40	43	42	42	41	47	44
Cyprus	42 (0.4)	41	42	43	42	44	42	43	42	41	41	41	42	42	44	43	42	45	46	41	43	42	47	42	45	47	43	42	51	44	43	42	[illegible]	43	42	42	41	46	44
Greece	40 (0.6)	40	41	41	41	43	41	41	40	42	42	40	41	41	46	41	41	44	47	41	42	40	46	42	45	47	44	41	51	42	44	41	40	[illegible]	40	41	39	45	45
Lithuania	38 (0.8)	37	39	39	39	41	38	39	37	37	38	38	38	37	43	40	38	42	45	39	39	38	44	39	42	44	40	38	50	40	41	38	36	39	[illegible]	38	37	42	41
Portugal	37 (0.6)	35	37	37	37	38	37	37	35	36	37	36	37	36	42	37	36	41	44	37	38	37	43	39	42	44	40	37	49	38	41	37	34	37	37	[illegible]	35	41	39
Iran, Islamic Rep.	32 (0.5)	32	32	33	33	33	33	33	32	32	32	32	33	32	35	33	33	35	36	33	34	32	37	32	35	37	34	32	41	33	34	32	31	33	32	32	[illegible]	37	33
Colombia	26 (0.6)	25	26	26	27	27	26	26	25	26	26	26	26	26	30	26	26	30	32	26	27	26	31	28	30	32	29	26	35	27	29	26	24	27	26	26	25	[illegible]	28
South Africa	23 (0.9)	22	22	23	23	24	22	23	22	23	23	22	23	23	25	23	22	24	26	22	23	23	25	23	24	26	24	23	29	23	25	22	22	24	22	23	22	24	[illegible]
International Average	**49 (0.8)**	**48**	**49**	**50**	**50**	**52**	**49**	**50**	**48**	**50**	**49**	**49**	**49**	**49**	**55**	**50**	**49**	**53**	**56**	**49**	**51**	**49**	**56**	**52**	**54**	**56**	**53**	**49**	**61**	**50**	**53**	**49**	**48**	**50**	**49**	**49**	**48**	**53**	**52**

*Seventh grade in most countries; see Table 2 for more information about the grades tested in each country

**Of the 151 items in the mathematics test, some items had two parts and some extended-response items were scored on a two- or three-point scale, resulting in 162 total score points

( ) Standard errors for the average percent of correct reponses on all items appear in parentheses. Standard errors for scores based on subsets of items are provided in Table B.4

Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3 for details).

Because population coverage falls below 65% Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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each table show how each country performed on the subset of items that it selected based on its own curriculum. Thus, the Swiss students themselves averaged 64% correct responses on the items identified by Switzerland for the analysis.

The international averages presented across the last row of the tables show that the selection of items for the participating countries varied somewhat in average difficulty, ranging from 54% to 58% at the eighth grade and from 48% to 61% at the seventh grade. Despite these differences, the overall picture provided by both Tables B.1 and B.2 reveals that different item selections do not make a major difference in how well countries perform relative to each other. The items selected by some countries were more difficult than those selected by others. The relative performance of countries on the various item selections did vary somewhat, but generally not in a statistically significant manner.[5]

Comparing the diagonal element for a country with the overall average percentage correct shows the difference between performance on this subset of items and performance on the test as a whole. In general, there were small increases in each country's performance on its own subset of items. To illustrate, the average percent correct for eighth-grade students in the Russian Federation is 60%. The diagonal element shows that Russian students had about the same average percent correct (62%) based on the smaller set of items selected as relevant to the curriculum in the Russian Federation as they did overall. In the eighth grade, the differences were extremely small (2 average percentage points or less) for most countries. Only a few countries had an average percent correct on their own selected items more than 3 percentage points higher than their average on the test as a whole. Performance differences between the entire TIMSS test and the subset of items selected for the TCMA were, in general, somewhat larger for seventh-grade students, including several countries with average performance that was 5 to 10 percentage points higher on the items selected for the TCMA for their own students. The largest increase (16 average percentage points) was for the seventh-grade students in Denmark.

It is clear that the selection of items does not have a major effect on the general relationship among countries. Countries that had substantially higher or lower performance on the overall test in comparison to each other also had higher or lower relative performance on the different sets of items selected for the TCMA. At the eighth grade, Singapore, Japan, Korea, and Hong Kong were the highest-performing countries and in the same order of performance, both on the test as a whole and on all the different sets of item selections. At the seventh grade, Singapore had the highest average percent correct on the test as a whole and on all of the different item selections, with Japan, Korea, Hong Kong, and Belgium (Flemish) among the top five highest performing countries in all cases. Although there were some changes in the ordering of countries based on the items selected for the TCMA, most of these differences are within the boundaries of sampling error. As the most extreme example, consider the 59 score points selected by Denmark for the seventh grade. Denmark did substantially better on these items than on the test as a whole, with 60% correct responses to these items, on average, compared to only 44% average correct on the test as a whole. However, all other countries also did better on these particular items, with an international average of 61% for the items selected by Denmark compared with 49% on the test as a whole. Also, for example, Scotland, Norway, and Latvia (LSS), which also averaged 44% correct over all items at the seventh grade, performed similarly to Denmark on the set of items selected by Denmark – 58%, 59%, and 56%, respectively.

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[5] Small differences in performance in these tables are not statistically significant. The standard errors for the estimated average percent correct statistics can found in Tables B.3 and B.4. We can say with 95% confidence that the value for the entire population will fall between the sample estimate plus or minus two standard errors.

The TCMA results provide evidence that the TIMSS mathematics test provides a reasonable basis for comparing achievement for the participating countries. This result is not unexpected, since making the test as fair as possible was a major consideration in test development. The fact that the majority of countries indicated that most items were appropriate for their students means that the different average percent correct estimates were based substantially on the same items. Insofar as countries rejected items that would be difficult for their own students, these items tended to be difficult for students in other countries as well. The analysis shows that omitting such items improves the results for that country, but also tends to improve the results for all other countries, so that the overall pattern of results is largely unaffected.

Table B.3 Standard Errors for the Test-Curriculum Matching Analysis Results - Mathematics - Upper Grade (Eighth Grade*)

See Table B.1 for the Test-Curriculum Matching Analysis Results

Instructions: Read ***across*** the row for the standard error for the score based on the test items included by each of the countries across the top

Read ***down*** the column under a country name for the standard error for the score of the country down the left on the items included by the country listed on the top

Read along the ***diagonal*** for the standard error for the score for each different country based on its own decisions about the test items to include

Country	Average Percent Correct on All Items	Singapore	Japan	Korea	Hong Kong	Belgium (Fl)	Czech Republic	Slovak Republic	Switzerland	*Austria*	Hungary	France	*Slovenia*	Russian Federation	*Netherlands*	*Bulgaria*	Canada	Ireland	*Belgium (Fr)*	*Australia*	*Israel*	Sweden	*Germany*	New Zealand	Norway	England	United States	*Denmark*	*Scotland*	Latvia (LSS)	Spain	Iceland	*Greece*	*Romania*	Lithuania	Cyprus	Portugal	Iran, Islamic Rep.	*Kuwait*	*Colombia*	*South Africa*
	(Number of Score Points Included) 162**	144	153	148	150	140	150	152	133	147	162	140	151	126	116	119	147	145	138	154	159	127	155	145	150	130	162	135	125	161	158	133	76	143	155	124	152	147	140	133	129
Singapore	79 (0.9)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Japan	73 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Korea	72 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Hong Kong	70 (1.4)	1.5	1.4	1.5	1.4	1.5	1.5	1.5	1.4	1.5	1.4	1.5	1.5	1.5	1.4	1.5	1.4	1.4	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.4	1.5	1.4	1.4	1.5	1.5	1.5
Belgium (Fl)	66 (1.4)	1.4	1.3	1.4	1.4	1.4	1.4	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.4	1.4	1.4	1.3	1.4	1.4	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.4	1.4	1.4	1.4	1.3	1.3	1.4	1.4
Czech Republic	66 (1.1)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Slovak Republic	62 (0.8)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.7	0.8	0.8	0.8	0.7	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Switzerland	62 (0.6)	0.6	0.6	0.7	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.6	0.6	0.6	0.7	0.6
Austria	62 (0.8)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Hungary	62 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.8
France	61 (0.8)	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Slovenia	61 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Russian Federation	60 (1.3)	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Netherlands	60 (1.6)	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.7	1.6	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Bulgaria	60 (1.3)	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.3	1.3	1.2	1.3	1.3	1.3	1.3	1.3	1.2	1.3	1.2	1.2	1.2	1.2	1.3	1.2	1.3	1.3	1.3	1.2	1.2	1.3	1.3	1.3
Canada	59 (0.5)	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.6
Ireland	59 (1.2)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Belgium (Fr)	59 (0.9)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9
Australia	58 (0.9)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9
Israel	57 (1.3)	1.4	1.4	1.4	1.3	1.4	1.3	1.3	1.3	1.4	1.3	1.4	1.3	1.4	1.3	1.4	1.3	1.4	1.4	1.3	1.4	1.4	1.4	1.3	1.4	1.3	1.3	1.3	1.4	1.3	1.3	1.4	1.5	1.4	1.3	1.4	1.3	1.4	1.4	1.4	1.4
Sweden	56 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Germany	54 (1.1)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
New Zealand	54 (1.0)	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.1	1.1	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.0	1.0	1.0	1.0	1.1	1.0	1.1	1.0	1.0	1.1	1.1	1.1
Norway	54 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
England	53 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.8	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.8	0.7	0.7	0.7	0.8	0.8
United States	53 (1.1)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Denmark	52 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Scotland	52 (1.4)	1.4	1.3	1.3	1.3	1.4	1.4	1.3	1.3	1.3	1.4	1.4	1.3	1.4	1.3	1.4	1.3	1.4	1.4	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.4	1.3	1.3	1.4	1.3	1.3	1.3	1.4	1.3	1.4	1.3	1.3	1.4	1.4	1.4
Latvia (LSS)	51 (0.8)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Spain	51 (0.5)	0.6	0.5	0.6	0.6	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.6
Iceland	50 (1.1)	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.2	1.1	1.2	1.2	1.3	1.1	1.1	1.2	1.1	1.1	1.2	1.1	1.2	1.2	1.2	1.1	1.2	1.2	1.1	1.1	1.0	1.1	1.1	1.1	1.2	1.1	1.2	1.1	1.2	1.2
Greece	49 (0.7)	0.8	0.7	0.8	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.8	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.8	0.7	0.8	0.7	0.7	0.8
Romania	49 (1.0)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lithuania	48 (0.9)	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	0.9	1.0	0.9	1.0	0.9	1.0	0.9	1.0	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cyprus	48 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Portugal	43 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Iran, Islamic Rep.	38 (0.6)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Kuwait	30 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.8	0.7	0.7	0.8	0.7	0.7
Colombia	29 (0.8)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
South Africa	24 (1.1)	1.2	1.1	1.1	1.1	1.2	1.2	1.1	1.2	1.2	1.1	1.2	1.1	1.2	1.1	1.1	1.2	1.2	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.2	1.2	1.1	1.1	1.2	1.1	1.2	1.1	1.2	1.2	1.1	1.2	1.1	1.1
International Average	**55 (0.9)**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**	**0.9**

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

**Of the 151 items in the mathematics test, some items had two parts and some extended response items were scored on a two- or three-point scale, resulting in 162 total score points.

( ) Standard errors for the average percent of correct responses on all items appear in parentheses. The matrix contains standard errors corresponding to the average percent of correct responses based on TCMA subsets of items as displayed in Table B.1. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3 for details).

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Table B.4 Standard Errors for the Test-Curriculum Matching Analysis Results - Mathematics - Lower Grade (Seventh Grade*)

See Table B.3 for the Test-Curriculum Matching Analysis Results

Instructions Read ***across*** the row for the standard error for the score based on the test items included by each of the countries across the top

Read ***down*** the column under a country name for the standard error for the score of the country down the left on the items included by the country listed on the top

Read along the ***diagonal*** for the standard error for the score for each different country based on its own decisions about the test items to include

Country	Average Percent Correct on All Items	Singapore	Japan	Korea	Hong Kong	Belgium (Fl)	Czech Republic	*Austria*	*Bulgaria*	*Netherlands*	Belgium (Fr)	Slovak Republic	Hungary	Ireland	Switzerland	Russian Federation	*Slovenia*	*Australia*	Canada	France	*Germany*	United States	England	Sweden	New Zealand	Scotland	Norway	Latvia (LSS)	*Denmark*	*Romania*	Iceland	Spain	Cyprus	*Greece*	Lithuania	Portugal	Iran, Islamic Rep.	*Colombia*	*South Africa*
(Number of Score Points Included)	162**	126	145	144	139	104	145	131	119	81	104	152	158	113	91	121	144	114	87	128	132	162	93	100	115	76	118	150	59	87	102	150	101	108	146	146	128	89	81
Singapore	73 (1.3)	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.3	1.3	1.3	1.2	1.3	1.3	1.2	1.2	1.3	1.3	1.3	1.2	1.3	1.2	1.2	1.3	1.3	1.0	1.3	1.3	1.3	1.4	1.3	1.3	1.3	1.3	1.2	1.3
Japan	67 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Korea	67 (0.6)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6
Hong Kong	65 (1.8)	1.9	1.8	1.8	1.8	1.8	1.8	1.9	1.9	1.8	1.8	1.8	1.8	1.8	1.7	1.8	1.8	1.7	1.7	1.8	1.7	1.8	1.7	1.7	1.7	1.7	1.7	1.8	1.6	1.9	1.7	1.8	1.9	1.8	1.8	1.8	1.8	1.8	1.8
Belgium (Fl)	65 (0.8)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.9	0.8	0.8	0.8	0.7	0.8	0.8	0.7	0.7	0.8	0.8	0.8	0.7	0.8	0.7	0.7	0.8	0.8	0.7	0.9	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8
Czech Republic	57 (1.2)	1.2	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.2	1.1	1.2	1.1	1.1	1.1	1.1	1.1	1.2	1.0	1.1	1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.1	1.3
Austria	56 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7
Bulgaria	55 (1.7)	1.9	1.7	1.8	1.7	1.8	1.7	1.8	1.9	1.8	1.8	1.7	1.7	1.8	1.6	1.8	1.8	1.6	1.5	1.7	1.6	1.7	1.5	1.6	1.6	1.7	1.6	1.7	1.5	1.7	1.5	1.7	1.9	1.8	1.8	1.7	1.9	1.7	1.7
Netherlands	55 (1.0)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.0	1.0	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.0	1.0	1.0	1.0	1.1
Belgium (Fr)	54 (0.9)	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.8	0.9	0.9	0.9	0.9	1.0	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9
Slovak Republic	54 (0.8)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8
Hungary	54 (0.8)	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.8	0.9	0.8	0.9	0.9	0.9	0.9	0.8	0.9	0.8	0.9
Ireland	53 (1.0)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0
Switzerland	53 (0.5)	0.6	0.6	0.5	0.5	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.7	0.6	0.5	0.7	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.5	0.6	0.6
Russian Federation	53 (0.9)	1.0	0.9	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	1.0	1.0	0.9	1.0	1.0	1.0	1.0
Slovenia	53 (0.7)	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.6	0.6	0.7	0.7	0.7	0.6	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7
Australia	52 (0.8)	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.9	0.9	0.9	0.8	0.8	0.9	0.8	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.8	0.8	0.8	0.9	0.9
Canada	52 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.6	0.5	0.5	0.5	0.6	0.5
France	51 (0.8)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Germany	49 (1.1)	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.1	1.0	1.0	1.1	1.0	1.1	1.0	1.1	1.0	1.1
United States	48 (1.2)	1.3	1.2	1.3	1.3	1.3	1.2	1.3	1.3	1.3	1.3	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.2	1.2	1.3	1.3	1.2	1.3	1.2	1.3	1.4
England	47 (0.9)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.9	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Sweden	47 (0.6)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.7	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
New Zealand	46 (0.9)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9
Scotland	44 (0.9)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0	1.0	0.9	0.9	0.9	1.0	0.9	0.9	0.9	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	0.9	1.0	0.3	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.0
Norway	44 (0.7)	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.6	0.8	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.8	0.7	0.7	0.8	0.7	0.7	0.8	0.7	0.7	0.6	0.8	0.7	0.7	0.7	0.7	0.7	0.8
Latvia (LSS)	44 (0.7)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.8	0.7	0.8	0.7	0.8	0.8	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.8	0.8	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Denmark	44 (0.5)	0.6	0.5	0.5	0.5	0.6	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.6	0.6	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.5	0.6	0.5	0.6	0.6	0.5	0.5	0.5	0.6	0.6
Romania	43 (0.8)	0.9	0.8	0.9	0.8	0.9	0.8	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.8	0.8	0.9	0.8	0.9
Iceland	43 (0.6)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.7	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6
Spain	42 (0.5)	0.6	0.5	0.6	0.5	0.6	0.5	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.6	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.5	0.5	0.6	0.6	0.6	0.5	0.5	0.6	0.6
Cyprus	42 (0.4)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.4
Greece	40 (0.6)	0.6	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.7	0.6	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.6	0.7	0.7	0.6	0.6	0.6	0.7	0.7
Lithuania	38 (0.8)	0.8	0.8	0.8	0.9	0.9	0.8	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.8	0.9	0.9	0.8	0.8	0.8	0.9	0.8	0.8	0.9	0.8	0.8	0.9	0.9	0.8	0.8	0.9	0.9	0.8	0.8	0.8	0.9	0.9
Portugal	37 (0.6)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Iran, Islamic Rep.	32 (0.5)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.6	0.5	0.5	0.5	0.7	0.6	0.6	0.6	0.6	0.5	0.8	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.6	0.5
Colombia	26 (0.6)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.7	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.8	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7
South Africa	23 (0.9)	1.0	1.0	0.9	1.0	1.0	1.0	1.0	0.9	1.0	1.0	0.9	0.9	0.9	1.1	1.0	1.0	1.0	1.1	1.0	1.0	0.9	1.1	1.0	1.1	1.1	1.0	0.9	1.1	0.9	1.0	0.9	1.0	1.0	1.0	1.0	0.9	1.1	[illegible]
International Average	**49 (0.8)**	**0.8**	**0.8**	**0.8**	**0.8**	**0.9**	**0.8**	**0.8**	**0.9**	**0.9**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.8**	**0.9**	**0.9**	**0.8**	**0.8**	**0.8**	**0.8**	**0.9**

*Seventh grade in most countries; see Table 2 for more information about the grades tested in each country.

**Of the 151 items in the mathematics test, some items had two parts and some extended response items were scored on a two- or three-point scale, resulting in 162 total score points.

( ) Standard errors for the average percent of correct responses on all items appear in parentheses. The matrix contains standard errors corresponding to the average percent of correct responses based on TCMA subsets of items, as displayed in Table B.2. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

Countries shown in italics did not satisfy one or more guidelines for sample participation rates, age/grade specifications, or classroom sampling procedures (see Figure A.3 for details).

Because population coverage falls below 65%, Latvia is annotated LSS for Latvian Speaking Schools only.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Appendix C

SELECTED MATHEMATICS ACHIEVEMENT RESULTS FOR THE PHILIPPINES

Table C.1

Philippines - Selected Mathematics Achievement Results - Unweighted Data

Distributions of Mathematics Achievement - Seventh Grade

Mean	Years of Formal Schooling	Average Age	5th Percentile (Scale Score)	Data Rep., Analysis, and Prob.	50th Percentile (Scale Score)	75th Percentile (Scale Score)	95th Percentile (Scale Score)
399 (1.9)	7	14.0	291 (1.0)	349 (1.3)	389 (1.1)	440 (2.8)	546 (1.4)

Distributions of Mathematics Achievement - Sixth Grade

Mean	Years of Formal Schooling	Average Age	5th Percentile (Scale Score)	Data Rep., Analysis, and Prob.	50th Percentile (Scale Score)	75th Percentile (Scale Score)	95th Percentile (Scale Score)
386 (1.0)	6	12.9	284 (1.4)	339 (0.4)	377 (0.7)	422 (2.6)	531 (1.6)

Gender Differences in Mathematics Achievement - Seventh Grade

Boys Mean	Girls Mean	Difference
396 (2.3)	402 (1.8)	6 (2.9)

Gender Differences in Mathematics Achievement - Sixth Grade

Boys Mean	Girls Mean	Difference
384 (1.0)	388 (1.2)	4 (1.6)

Percentages of Students Achieving International Marker Levels in Mathematics Seventh Grade

Top 10% Level	Top Quarter Level	Top Half Level
1 (0.1)	2 (0.2)	10 (0.6)

Percentages of Students Achieving International Marker Levels in Mathematics Sixth Grade

Top 10% Level	Top Quarter Level	Top Half Level
1 (0.0)	3 (0.1)	11 (0.2)

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table C.1 (Continued)

Philippines - Selected Mathematics Achievement Results - Unweighted Data

Average Percent Correct by Mathematics Content Areas - Seventh Grade

Mathematics Overall	Fractions and Number Sense	Geometry	Algebra	Data Rep., Analysis, and Prob.	Measurement	Proportionality
33 (0.4)	39 (0.5)	32 (0.4)	31 (0.5)	39 (0.5)	21 (0.4)	27 (0.5)

Average Percent Correct by Mathematics Content Areas -Sixth Grade

Mathematics Overall	Fractions and Number Sense	Geometry	Algebra	Data Rep., Analysis, and Prob.	Measurement	Proportionality
31 (0.2)	36 (0.3)	30 (0.3)	28 (0.2)	36 (0.3)	20 (0.2)	25 (0.3)

Average Percent Correct for Boys and Girls by Mathematics Content Areas Seventh Grade

Mathematics Overall		Fractions & Number Sense		Geometry		Algebra	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
32 (0.5)	33 (0.4)	37 (0.6)	39 (0.5)	33 (0.5)	32 (0.4)	30 (0.6)	32 (0.5)

Data Representation, Analysis & Probability		Measurement		Proportionality	
Boys	Girls	Boys	Girls	Boys	Girls
38 (0.6)	40 (0.5)	22 (0.5)	21 (0.4)	27 (0.6)	27 (0.5)

Average Percent Correct for Boys and Girls by Mathematics Content Areas Sixth Grade

Mathematics Overall		Fractions & Number Sense		Geometry		Algebra	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
30 (0.3)	31 (0.3)	36 (0.3)	37 (0.4)	29 (0.4)	30 (0.4)	27 (0.3)	29 (0.3)

Data Representation, Analysis & Probability		Measurement		Proportionality	
Boys	Girls	Boys	Girls	Boys	Girls
35 (0.4)	37 (0.4)	20 (0.3)	20 (0.2)	25 (0.3)	26 (0.3)

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*Seventh or Eighth grades in most countries; see Table 2 for information about the grades tested in the Philippines.

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Appendix D

SELECTED MATHEMATICS ACHIEVEMENT RESULTS FOR DENMARK, SWEDEN, AND SWITZERLAND (GERMAN-SPEAKING) – EIGHTH GRADE

Table D.1

Denmark - Selected Mathematics Achievement Results

Distributions of Mathematics Achievement - Eighth Grade

Mean	Years of Formal Schooling	Average Age	5th Percentile (Scale Score)	25th Percentile (Scale Score)	50th Percentile (Scale Score)	75th Percentile (Scale Score)	95th Percentile (Scale Score)
542 (2.9)	8	14.9	400 (3.9)	481 (1.7)	542 (5.9)	609 (3.2)	679 (7.2)

Gender Differences in Mathematics Achievement - Eighth Grade

Boys Mean	Girls Mean	Difference
547 (3.6)	537 (4.1)	10 (5.4)

Percentages of Students Achieving International Marker Levels in Mathematics Eighth Grade

Top 10% Level	Top Quarter Level	Top Half Level
5 (0.5)	19 (1.0)	42 (1.4)

Average Percent Correct by Mathematics Content Areas - Eighth Grade

Mathematics Overall	Fractions and Number Sense	Geometry	Algebra	Data Rep., Analysis, and Prob.	Measurement	Proportionality
60 (0.7)	62 (0.8)	59 (0.9)	54 (0.8)	73 (0.8)	59 (0.9)	47 (0.8)

Average Percent Correct for Boys and Girls by Mathematics Content Areas Eighth Grade

Mathematics Overall		Fractions & Number Sense		Geometry		Algebra	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
61 (0.8)	59 (1.0)	64 (0.9)	60 (1.2)	58 (1.0)	60 (1.3)	55 (1.1)	55 (1.1)

Data Representation, Analysis & Probability		Measurement		Proportionality	
Boys	Girls	Boys	Girls	Boys	Girls
74 (1.1)	71 (1.0)	61 (1.0)	57 (1.3)	49 (1.1)	45 (1.2)

( ) Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table D.2

Sweden - Selected Mathematics Achievement Results

Distributions of Mathematics Achievement - Eighth Grade

Mean	Years of Formal Schooling	Average Age	5th Percentile (Scale Score)	25th Percentile (Scale Score)	50th Percentile (Scale Score)	75th Percentile (Scale Score)	95th Percentile (Scale Score)
554 (4.4)	8	14.9	407 (10.9)	491 (3.1)	559 (11.5)	621 (2.4)	699 (2.2)

Gender Differences in Mathematics Achievement - Eighth Grade

Boys Mean	Girls Mean	Difference
553 (5.0)	555 (5.0)	2 (7.1)

Percentages of Students Achieving International Marker Levels in Mathematics Eighth Grade

Top 10% Level	Top Quarter Level	Top Half Level
8 (0.8)	23 (1.5)	48 (2.3)

Average Percent Correct by Mathematics Content Areas - Eighth Grade

Mathematics Overall	Fractions and Number Sense	Geometry	Algebra	Data Rep., Analysis, and Prob.	Measurement	Proportionality
62 (1.1)	68 (1.1)	56 (1.1)	54 (1.3)	76 (1.1)	61 (1.2)	50 (1.4)

Average Percent Correct for Boys and Girls by Mathematics Content Areas Eighth Grade

Mathematics Overall		Fractions & Number Sense		Geometry		Algebra	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
62 (1.2)	63 (1.1)	67 (1.2)	68 (1.2)	57 (1.3)	55 (1.2)	52 (1.4)	55 (1.5)

Data Representation, Analysis & Probability		Measurement		Proportionality	
Boys	Girls	Boys	Girls	Boys	Girls
76 (1.3)	76 (1.2)	61 (1.4)	61 (1.3)	50 (1.5)	50 (1.4)

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table D.3

Switzerland (German Speaking) - Selected Mathematics Achievement Results

Distributions of Mathematics Achievement - Eighth Grade

Mean	Years of Formal Schooling	Average Age	5th Percentile (Scale Score)	25th Percentile (Scale Score)	50th Percentile (Scale Score)	75th Percentile (Scale Score)	95th Percentile (Scale Score)
590 (3.2)	8	15.1	446 (5.8)	528 (7.2)	589 (3.8)	658 (4.2)	740 (5.7)

Gender Differences in Mathematics Achievement - Eighth Grade

Boys Mean	Girls Mean	Difference
598 (3.8)	584 (4.3)	14 (5.7)

Percentages of Students Achieving International Marker Levels in Mathematics Eighth Grade

Top 10% Level	Top Quarter Level	Top Half Level
18 (1.0)	35 (1.4)	61 (1.7)

Average Percent Correct by Mathematics Content Areas - Eighth Grade

Mathematics Overall	Fractions and Number Sense	Geometry	Algebra	Data Rep., Analysis, and Prob.	Measurement	Proportionality
70 (0.7)	74 (0.7)	69 (0.8)	65 (0.9)	78 (0.7)	70 (0.9)	60 (0.9)

Average Percent Correct for Boys and Girls by Mathematics Content Areas Eighth Grade

Mathematics Overall		Fractions & Number Sense		Geometry		Algebra	
Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
72 (0.7)	69 (0.9)	76 (0.7)	73 (1.0)	70 (1.0)	68 (1.0)	66 (1.0)	63 (1.3)

Data Representation, Analysis & Probability		Measurement		Proportionality	
Boys	Girls	Boys	Girls	Boys	Girls
79 (0.8)	77 (1.0)	71 (1.0)	68 (1.2)	62 (1.1)	59 (1.2)

() Standard errors appear in parentheses. Because results are rounded to the nearest whole number, some totals may appear inconsistent.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Appendix E

PERCENTILES AND STANDARD DEVIATIONS OF MATHEMATICS ACHIEVEMENT

Table E.1

Percentiles of Achievement in Mathematics Upper Grade (Eighth Grade*)

Country	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Australia	**372 (4.1)**	**460 (1.5)**	**529 (7.0)**	**600 (7.2)**	**690 (5.4)**
Austria	**393 (5.1)**	**474 (4.1)**	**537 (5.8)**	**608 (2.6)**	**693 (6.4)**
Belgium (Fl)	416 (7.7)	502 (8.7)	566 (8.7)	631 (5.7)	710 (3.5)
Belgium (Fr)	385 (13.8)	467 (1.1)	532 (5.5)	587 (3.7)	658 (6.2)
Bulgaria	378 (11.4)	460 (4.2)	530 (10.6)	621 (13.8)	728 (0.4)
Canada	389 (3.3)	468 (2.0)	527 (2.7)	587 (2.4)	670 (3.7)
Colombia	292 (5.8)	343 (4.4)	379 (3.6)	421 (6.1)	496 (7.5)
Cyprus	333 (3.3)	412 (1.2)	469 (1.6)	535 (3.2)	621 (7.3)
Czech Republic	423 (3.5)	496 (2.6)	558 (7.5)	633 (8.5)	725 (12.6)
Denmark	369 (9.8)	443 (2.9)	500 (4.9)	561 (2.2)	641 (5.9)
England	361 (8.8)	443 (4.8)	501 (3.5)	570 (2.7)	665 (4.1)
France	415 (5.2)	484 (1.4)	534 (3.0)	591 (2.5)	666 (3.4)
Germany	368 (8.2)	448 (9.4)	506 (6.3)	572 (7.5)	661 (10.9)
Greece	347 (2.8)	422 (1.9)	478 (3.8)	546 (3.6)	633 (6.6)
Hong Kong	415 (14.2)	526 (6.8)	595 (5.9)	659 (4.9)	742 (5.4)
Hungary	391 (2.3)	471 (2.1)	534 (2.6)	602 (2.7)	693 (9.2)
Iceland	365 (4.3)	435 (3.3)	481 (6.2)	540 (4.8)	615 (21.0)
Iran, Islamic Rep.	336 (4.4)	388 (2.2)	424 (2.9)	466 (5.8)	535 (9.8)
Ireland	381 (6.5)	462 (4.9)	526 (8.2)	594 (9.6)	681 (3.3)
Israel	371 (6.3)	459 (7.5)	523 (9.3)	586 (4.9)	672 (7.2)
Japan	435 (2.1)	536 (6.8)	608 (2.5)	676 (1.4)	771 (4.8)
Korea	418 (4.0)	540 (5.0)	609 (3.9)	682 (2.7)	786 (7.1)
Kuwait	302 (4.7)	355 (3.5)	389 (5.0)	427 (3.2)	493 (6.1)
Latvia (LSS)	375 (5.2)	435 (2.6)	487 (3.3)	550 (4.3)	638 (8.1)
Lithuania	348 (5.0)	422 (3.1)	473 (5.3)	533 (4.3)	616 (8.5)
Netherlands	397 (10.6)	477 (9.1)	543 (9.2)	604 (7.4)	688 (6.9)
New Zealand	366 (3.1)	443 (4.0)	503 (5.0)	570 (5.5)	663 (9.1)
Norway	372 (5.5)	445 (2.0)	499 (2.8)	560 (3.1)	649 (5.9)
Portugal	357 (3.0)	411 (1.0)	449 (2.2)	495 (6.7)	569 (7.1)
Romania	343 (3.1)	418 (3.0)	476 (5.5)	544 (5.2)	635 (9.7)
Russian Federation	388 (4.5)	471 (5.6)	536 (11.3)	600 (8.2)	687 (2.9)
Scotland	364 (2.1)	436 (3.2)	493 (7.2)	559 (7.1)	649 (15.3)
Singapore	499 (5.8)	584 (8.9)	642 (7.2)	704 (4.5)	792 (7.5)
Slovak Republic	401 (1.6)	483 (0.6)	543 (4.4)	612 (3.9)	700 (2.7)
Slovenia	404 (2.5)	477 (3.6)	535 (6.7)	604 (4.0)	690 (4.3)
South Africa	259 (3.7)	313 (2.2)	347 (2.0)	386 (4.9)	484 (10.4)
Spain	376 (2.0)	436 (2.5)	481 (1.8)	536 (3.5)	616 (3.9)
Sweden	384 (2.9)	460 (6.0)	515 (3.7)	579 (3.4)	661 (4.7)
Switzerland	401 (6.3)	485 (2.1)	549 (6.1)	607 (2.9)	685 (2.8)
Thailand	388 (3.7)	462 (4.4)	518 (5.9)	580 (6.8)	669 (12.0)
United States	356 (3.3)	435 (3.4)	494 (6.4)	563 (8.2)	653 (3.7)

*Eighth grade in most countries; see Table 2 for more information about the grades tested in each country.

() Standard errors appear in parentheses.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table E.2

Percentiles of Achievement in Mathematics Lower Grade (Seventh Grade*)

Country	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
Australia	350 (4.4)	435 (5.5)	495 (3.9)	564 (5.9)	651 (6.8)
Austria	378 (2.4)	450 (6.3)	506 (3.5)	568 (4.5)	652 (4.5)
Belgium (Fl)	436 (2.0)	506 (4.4)	556 (4.4)	608 (7.0)	688 (3.1)
Belgium (Fr)	382 (5.0)	456 (6.0)	506 (6.2)	562 (5.5)	640 (3.2)
Bulgaria	355 (8.1)	435 (4.9)	511 (11.0)	589 (7.2)	691 (15.6)
Canada	368 (2.0)	440 (5.0)	488 (1.9)	551 (3.2)	632 (5.9)
Colombia	273 (4.3)	329 (2.5)	362 (2.5)	404 (5.4)	476 (6.6)
Cyprus	320 (7.0)	386 (2.5)	440 (2.5)	504 (3.2)	585 (5.9)
Czech Republic	390 (1.9)	461 (6.1)	515 (5.7)	583 (8.2)	678 (4.9)
Denmark	342 (3.9)	412 (1.7)	464 (3.4)	516 (3.6)	595 (23.0)
England	342 (5.4)	410 (7.4)	469 (5.0)	540 (5.2)	639 (6.3)
France	375 (7.2)	444 (6.3)	491 (3.5)	543 (7.5)	615 (5.1)
Germany	353 (6.5)	426 (5.8)	481 (5.2)	542 (6.7)	629 (7.8)
Greece	308 (3.9)	380 (5.9)	434 (3.9)	499 (8.7)	586 (3.0)
Hong Kong	392 (12.5)	503 (7.5)	569 (10.4)	634 (6.9)	716 (5.3)
Hungary	365 (6.9)	437 (6.6)	496 (4.6)	562 (6.7)	656 (8.2)
Iceland	353 (2.4)	416 (3.0)	457 (2.2)	504 (4.1)	577 (6.6)
Iran, Islamic Rep.	316 (1.4)	363 (3.9)	396 (2.2)	436 (4.1)	503 (8.3)
Ireland	361 (4.0)	442 (3.3)	498 (6.8)	560 (7.1)	648 (11.3)
Japan	413 (7.1)	508 (2.2)	568 (1.9)	635 (3.0)	734 (7.0)
Korea	401 (7.6)	508 (5.2)	583 (5.9)	649 (3.7)	744 (2.3)
Latvia (LSS)	345 (5.0)	409 (4.4)	455 (2.4)	510 (3.2)	598 (4.6)
Lithuania	309 (4.0)	380 (3.5)	423 (4.3)	477 (2.9)	559 (5.4)
Netherlands	388 (8.5)	466 (3.2)	519 (8.0)	569 (3.7)	646 (6.9)
New Zealand	337 (6.4)	412 (5.4)	468 (3.2)	530 (9.0)	620 (2.5)
Norway	335 (5.3)	407 (6.0)	460 (4.4)	513 (4.0)	592 (9.8)
Portugal	332 (1.3)	385 (0.8)	417 (2.7)	461 (4.5)	528 (4.2)
Romania	325 (4.6)	394 (5.2)	449 (3.2)	513 (8.8)	600 (2.4)
Russian Federation	363 (5.5)	440 (6.7)	496 (3.9)	563 (5.6)	651 (3.9)
Scotland	337 (1.2)	405 (4.7)	459 (3.7)	520 (6.1)	604 (1.5)
Singapore	447 (8.0)	538 (9.7)	604 (12.1)	665 (6.4)	751 (6.0)
Slovak Republic	376 (3.2)	449 (4.2)	504 (4.4)	569 (3.1)	650 (9.4)
Slovenia	373 (3.8)	442 (5.7)	493 (3.0)	553 (4.6)	643 (3.8)
South Africa	254 (3.6)	308 (0.7)	342 (3.2)	382 (3.3)	462 (17.0)
Spain	342 (4.4)	400 (1.9)	441 (2.0)	494 (4.2)	572 (3.1)
Sweden	355 (3.6)	425 (2.0)	475 (2.0)	527 (2.9)	609 (8.9)
Switzerland	387 (12.4)	454 (3.3)	502 (3.0)	558 (3.0)	628 (4.0)
Thailand	373 (3.8)	440 (4.5)	490 (5.2)	547 (7.1)	632 (9.1)
United States	345 (8.0)	411 (3.1)	465 (3.2)	536 (11.7)	635 (12.1)

*Seventh grade in most countries; see Table 2 for more information about the grades tested in each country.

() Standard errors appear in parentheses.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

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Table E.3

Standard Deviations of Achievement in Mathematics Upper Grade (Eighth Grade*)

Country	Overall		Boys		Girls	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Australia	530 (4.0)	98	527 (5.1)	100	532 (4.6)	96
Austria	539 (3.0)	92	544 (3.2)	94	536 (4.5)	90
Belgium (Fl)	565 (5.7)	92	563 (8.8)	96	567 (7.4)	88
Belgium (Fr)	526 (3.4)	86	530 (4.7)	88	524 (3.7)	83
Bulgaria	540 (6.3)	110	– –	–	– –	–
Canada	527 (2.4)	86	526 (3.2)	88	530 (2.7)	84
Colombia	385 (3.4)	64	386 (6.9)	66	384 (3.6)	63
Cyprus	474 (1.9)	88	472 (2.8)	89	475 (2.5)	86
Czech Republic	564 (4.9)	94	569 (4.5)	94	558 (6.3)	93
Denmark	502 (2.8)	84	511 (3.2)	86	494 (3.4)	80
England	506 (2.6)	93	508 (5.1)	95	504 (3.5)	91
France	538 (2.9)	76	542 (3.1)	74	536 (3.8)	78
Germany	509 (4.5)	90	512 (5.1)	89	509 (5.0)	88
Greece	484 (3.1)	88	490 (3.7)	91	478 (3.1)	85
Hong Kong	588 (6.5)	101	597 (7.7)	103	577 (7.7)	97
Hungary	537 (3.2)	93	537 (3.6)	92	537 (3.6)	94
Iceland	487 (4.5)	76	488 (5.5)	80	486 (5.6)	72
Iran, Islamic Rep.	428 (2.2)	59	434 (2.9)	59	421 (3.3)	59
Ireland	527 (5.1)	93	535 (7.2)	96	520 (6.0)	89
Israel	522 (6.2)	92	539 (6.6)	89	509 (6.9)	90
Japan	605 (1.9)	102	609 (2.6)	106	600 (2.1)	97
Korea	607 (2.4)	109	615 (3.2)	109	598 (3.4)	108
Kuwait	392 (2.5)	58	– –	–	– –	–
Latvia (LSS)	493 (3.1)	82	496 (3.8)	82	491 (3.5)	82
Lithuania	477 (3.5)	80	477 (4.0)	79	478 (4.1)	81
Netherlands	541 (6.7)	89	545 (7.8)	90	536 (6.4)	88
New Zealand	508 (4.5)	90	512 (5.9)	92	503 (5.3)	88
Norway	503 (2.2)	84	505 (2.8)	87	501 (2.7)	80
Portugal	454 (2.5)	64	460 (2.8)	64	449 (2.7)	64
Romania	482 (4.0)	89	483 (4.8)	91	480 (4.0)	87
Russian Federation	535 (5.3)	92	535 (6.3)	97	536 (5.0)	87
Scotland	498 (5.5)	87	506 (6.6)	89	490 (5.2)	85
Singapore	643 (4.9)	88	642 (6.3)	88	645 (5.4)	88
Slovak Republic	547 (3.3)	92	549 (3.7)	94	545 (3.6)	90
Slovenia	541 (3.1)	88	545 (3.8)	88	537 (3.3)	87
South Africa	354 (4.4)	65	360 (6.3)	68	349 (4.1)	62
Spain	487 (2.0)	73	492 (2.5)	75	483 (2.6)	72
Sweden	519 (3.0)	85	520 (3.6)	85	518 (3.1)	86
Switzerland	545 (2.8)	88	548 (3.5)	90	543 (3.1)	85
Thailand	522 (5.7)	86	517 (5.6)	84	526 (7.0)	87
United States	500 (4.6)	91	502 (5.2)	93	497 (4.5)	89

*Eighth grade in most countries; see Table 2 for information about the grades tested in each country.

A dash (–) indicates data are not available.

( ) Standard errors appear in parentheses.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Table E.4

Standard Deviations of Achievement in Mathematics Lower Grade (Seventh Grade*)

Country	Overall		Boys		Girls	
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**	**Mean**	**Standard Deviation**
Australia	498 (3.8)	92	495 (5.2)	94	500 (4.3)	90
Austria	509 (3.0)	85	510 (4.6)	89	509 (3.3)	81
Belgium (Fl)	558 (3.5)	77	557 (4.5)	76	559 (4.7)	78
Belgium (Fr)	507 (3.5)	78	514 (4.1)	79	501 (4.2)	76
Bulgaria	514 (7.5)	103	– –	–	– –	–
Canada	494 (2.2)	80	495 (2.7)	80	493 (2.6)	80
Colombia	369 (2.7)	63	372 (3.8)	62	365 (3.9)	63
Cyprus	446 (1.9)	82	446 (2.5)	86	446 (2.6)	78
Czech Republic	523 (4.9)	89	527 (4.8)	90	520 (5.6)	88
Denmark	465 (2.1)	78	468 (2.8)	79	462 (2.9)	76
England	476 (3.7)	90	484 (6.2)	91	467 (4.3)	88
France	492 (3.1)	74	497 (3.6)	75	489 (3.3)	72
Germany	484 (4.1)	85	486 (4.8)	86	484 (4.5)	83
Greece	440 (2.8)	85	440 (3.2)	88	440 (3.0)	83
Hong Kong	564 (7.8)	99	570 (9.7)	103	556 (8.3)	94
Hungary	502 (3.7)	91	503 (3.8)	93	501 (4.4)	88
Iceland	459 (2.6)	68	460 (2.7)	68	458 (3.2)	68
Iran, Islamic Rep.	401 (2.0)	57	407 (2.7)	57	393 (2.3)	55
Ireland	500 (4.1)	87	507 (6.0)	87	494 (4.8)	86
Israel	– –	–	– –	–	– –	–
Japan	571 (1.9)	96	576 (2.7)	100	565 (2.0)	91
Korea	577 (2.5)	105	584 (3.7)	104	567 (4.4)	104
Kuwait	– –	–	– –	–	– –	–
Latvia (LSS)	462 (2.8)	77	463 (3.5)	77	460 (3.3)	76
Lithuania	428 (3.2)	75	423 (3.6)	77	433 (3.5)	73
Netherlands	516 (4.1)	79	517 (5.2)	80	515 (4.3)	77
New Zealand	472 (3.8)	87	473 (4.6)	89	470 (3.8)	84
Norway	461 (2.8)	76	462 (3.3)	77	459 (3.2)	75
Portugal	423 (2.2)	60	426 (2.7)	61	420 (2.2)	59
Romania	454 (3.4)	84	457 (3.7)	84	452 (3.7)	84
Russian Federation	501 (4.0)	88	502 (5.1)	91	499 (3.5)	85
Scotland	463 (3.7)	82	465 (4.6)	84	462 (3.8)	79
Singapore	601 (6.3)	93	601 (7.1)	94	601 (8.0)	92
Slovak Republic	508 (3.4)	85	511 (4.4)	87	505 (3.3)	83
Slovenia	498 (3.0)	82	501 (3.5)	82	496 (3.2)	82
South Africa	348 (3.8)	63	352 (5.3)	67	344 (3.3)	60
Spain	448 (2.2)	70	451 (2.7)	72	445 (2.7)	67
Sweden	477 (2.5)	77	480 (2.8)	77	475 (3.2)	76
Switzerland	506 (2.3)	75	513 (2.9)	76	498 (2.6)	74
Thailand	495 (4.8)	79	494 (4.8)	78	495 (5.7)	79
United States	476 (5.5)	89	478 (5.7)	92	473 (5.7)	86

*Seventh grade in most countries; see Table 2 for information about the grades tested in each country.

A dash (–) indicates data are not available. Israel and Kuwait did not test the lower grade.

( ) Standard errors appear in parentheses.

SOURCE: IEA Third International Mathematics and Science Study (TIMSS), 1994-95.

Appendix F

Acknowledgments

TIMSS was truly a collaborative effort among hundreds of individuals around the world. Staff from the national research centers, the international management, advisors, and funding agencies worked closely to design and implement the most ambitious study of international comparative achievement ever undertaken. TIMSS would not have been possible without the tireless efforts of all involved. Below, the individuals and organizations are acknowledged for their contributions. Given that implementing TIMSS has spanned more than seven years and involved so many people and organizations, this list may not pay heed to all who contributed throughout the life of the project. Any omission is inadvertent. TIMSS also acknowledges the students, teachers, and school principals who contributed their time and effort to the study. This report would not be possible without them.

MANAGEMENT AND OPERATIONS

Since 1993, TIMSS has been directed by the International Study Center at Boston College in the United States. Prior to this, the study was coordinated by the International Coordinating Center at the University of British Columbia in Canada. Although the study was directed centrally by the International Study Center and its staff members implemented various parts of TIMSS, important activities also were carried out in centers around the world. The data were processed centrally by the IEA Data Processing Center in Hamburg, Germany. Statistics Canada was responsible for collecting and evaluating the sampling documentation from each country and for calculating the sampling weights. The Australian Council for Educational Research conducted the scaling of the achievement data.

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Funding for the International Study Center was provided by the National Center for Education Statistics of the U.S. Department of Education, the U.S. National Science Foundation, and the International Association for the Evaluation for Educational Achievement. Eugene Owen and Lois Peak of the National Center for Education Statistics and Larry Suter of the National Science Foundation each played a crucial role in making TIMSS possible and for ensuring the quality of the study. Funding for the International Coordinating Center was provided by the Applied Research Branch of the Strategic Policy Group of the Canadian Ministry of Human Resources Development. This initial source of funding was vital to initiate the TIMSS project. Tjeerd Plomp, Chair of the IEA and of the TIMSS Steering Committee, has been a constant source of support throughout TIMSS. It should be noted that each country provided its own funding for the implementation of the study at the national level.

NATIONAL RESEARCH COORDINATORS

The TIMSS National Research Coordinators and their staff had the enormous task of implementing the TIMSS design in their countries. This required obtaining funding for the project; participating in the development of the instruments and procedures; conducting field tests; participating in and conducting training sessions; translating the instruments and procedural manuals into the local language; selecting the sample of schools and students; working with the schools to arrange for the testing; arranging for data collection, coding, and data entry; preparing the data files for submission to the IEA Data Processing Center; contributing to the development of the international reports; and preparing national reports. The way in which the national centers operated and the resources that were available varied considerably across the TIMSS countries. In some countries, the tasks were conducted centrally, while in others, various components were subcontracted to other organizations. In some countries, resources were more than adequate, while in others, the national centers were operating with limited resources. Of course, across the life of the project, some NRCs have changed. This list attempts to include all past NRCs who served for a significant period of time as well as all the present NRCs. All of the TIMSS National Research Coordinators and their staff members are to be commended for their professionalism and their dedication in conducting all aspects of TIMSS.

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The International Study Center was supported in its work by several advisory committees. The International Steering Committee provided guidance to the International Study Director on policy issues and general direction of the study. The TIMSS Technical Advisory Committee provided guidance on issues related to design, sampling, instrument construction, analysis, and reporting, ensuring that the TIMSS methodologies and procedures were technically sound. The Subject Matter Advisory Committee ensured that current thinking in mathematics and science education were addressed by TIMSS, and was instrumental in the development of the TIMSS tests. The Free-Response Item Coding Committee developed the coding rubrics for the free-response items. The Performance Assessment Committee worked with the Performance Assessment Coordinator to develop the TIMSS performance assessment. The Quality Assurance Committee helped to develop the quality assurance program.

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